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You et al.

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(54) **BOTTOM CHASSIS, METHOD OF MANUFACTURING THE SAME, AND DISPLAY APPARATUS INCLUDING THE SAME**

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F21V 8/00 (2006.01)

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(58) **Field of Classification Search**
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USPC 362/624, 628, 632–633; 349/58, 61, 65
See application file for complete search history.

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(57) **ABSTRACT**

A bottom chassis includes a base chassis which accommodates a light source part emitting a light, a reflective film disposed on a bottom plate of the base chassis and including a reflective material to reflect the light, a cladding film disposed on the reflective film, and a light guide film disposed on the cladding film, receiving the light from the light source part through a first surface thereof, and guiding the received light to exit through a second surface thereof as a plane light, where the cladding film has a refractive index smaller than a refractive index of the light guide film.

22 Claims, 21 Drawing Sheets

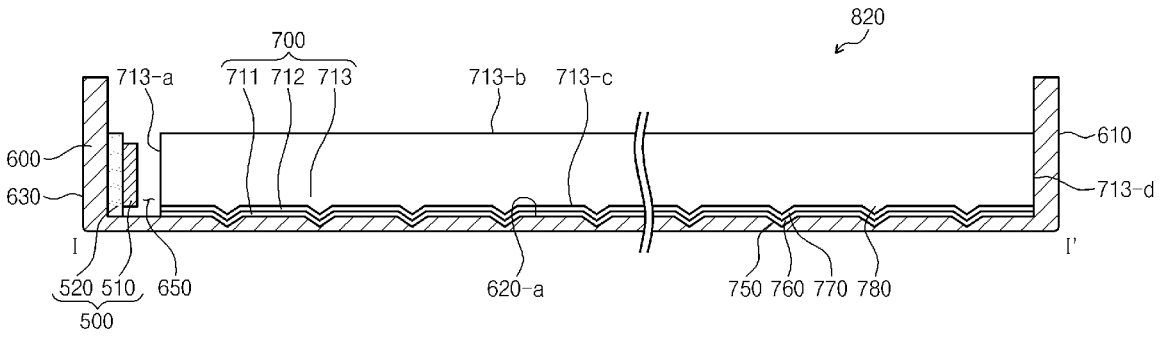

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Fig. 1

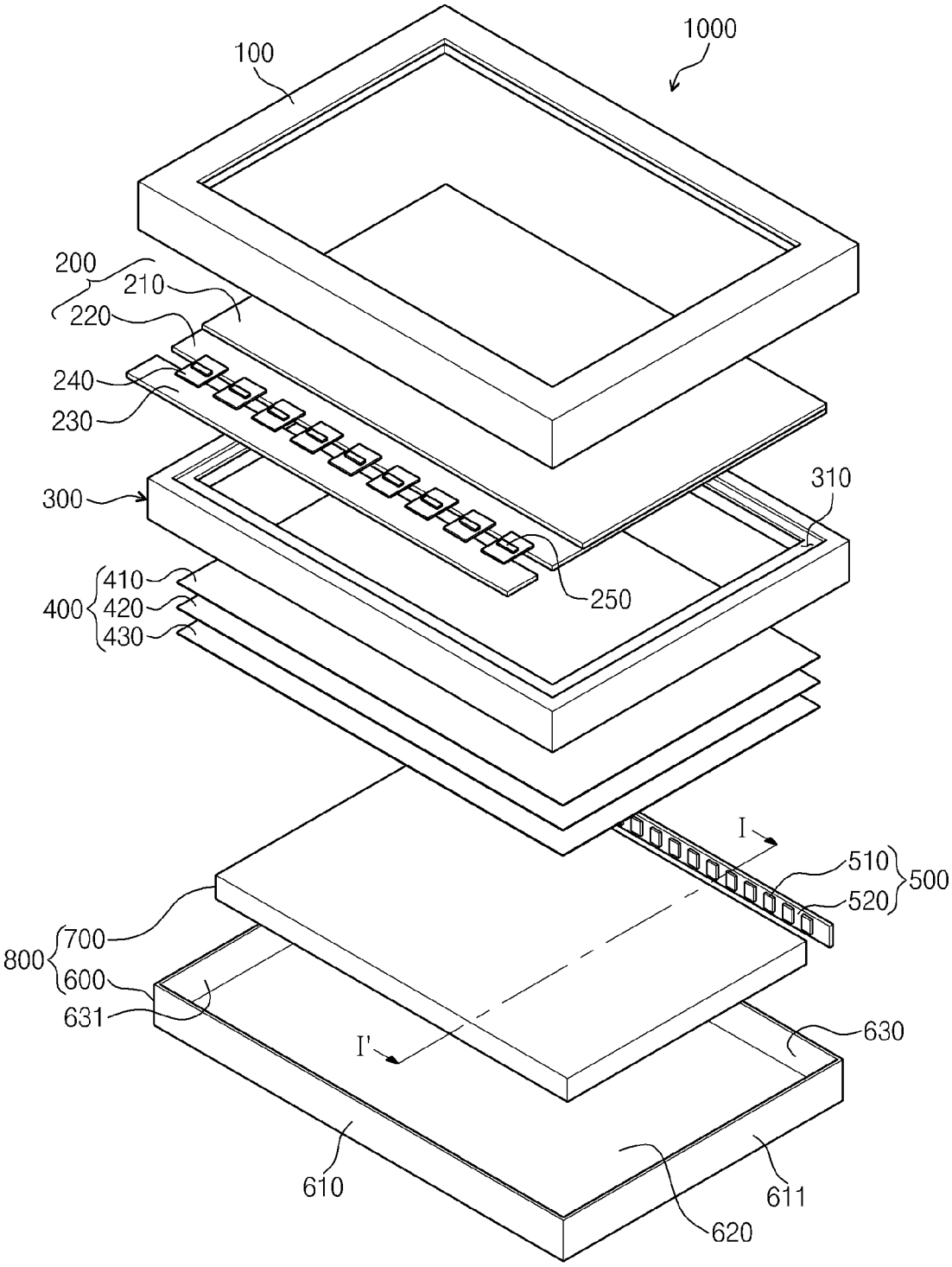
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Fig. 2

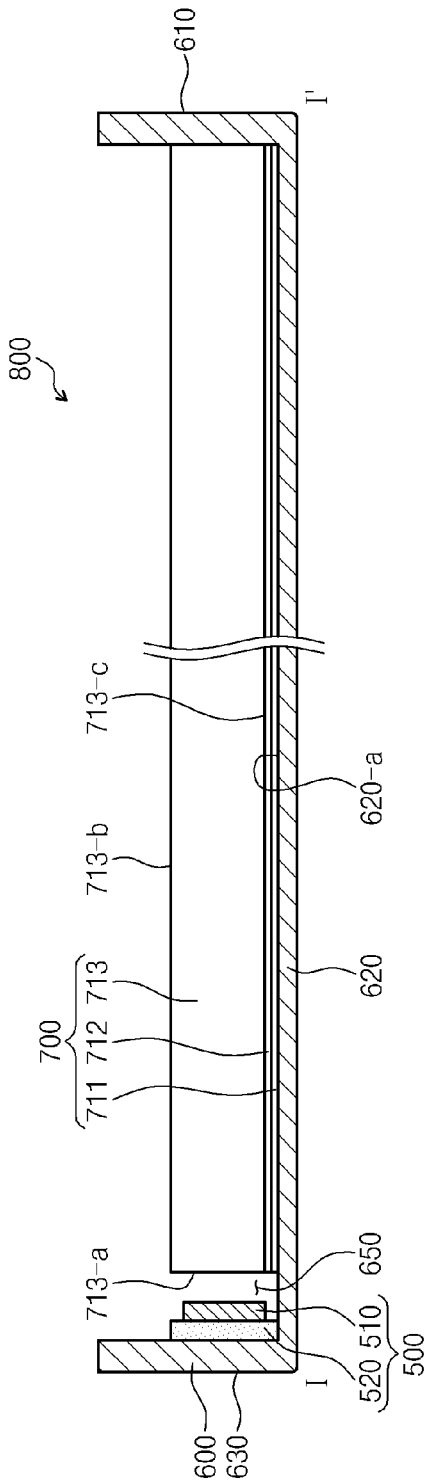
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Fig. 3

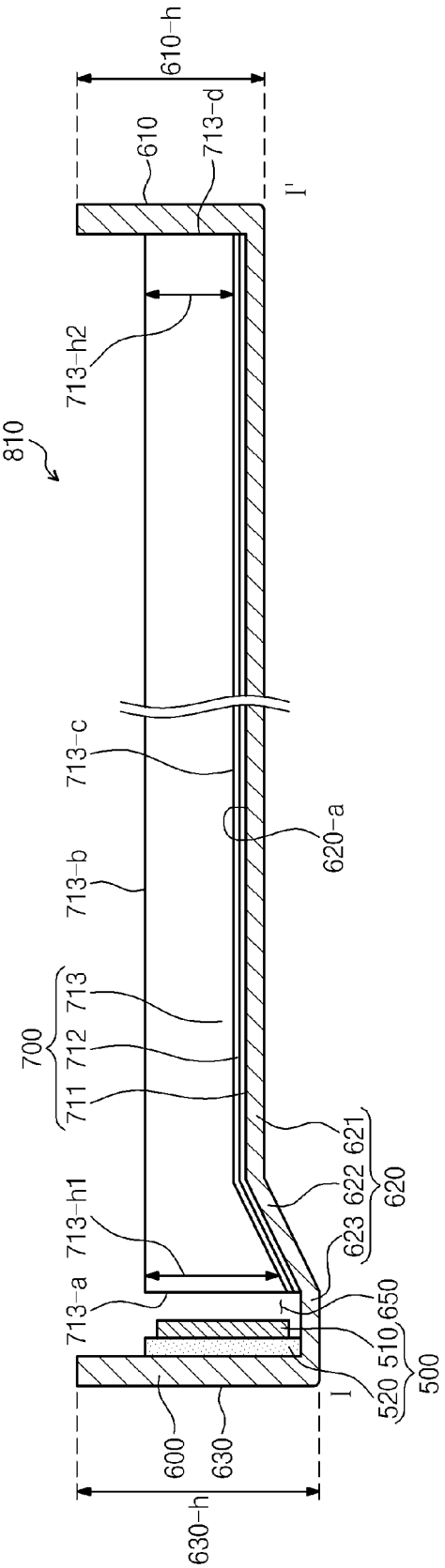
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Fig. 4

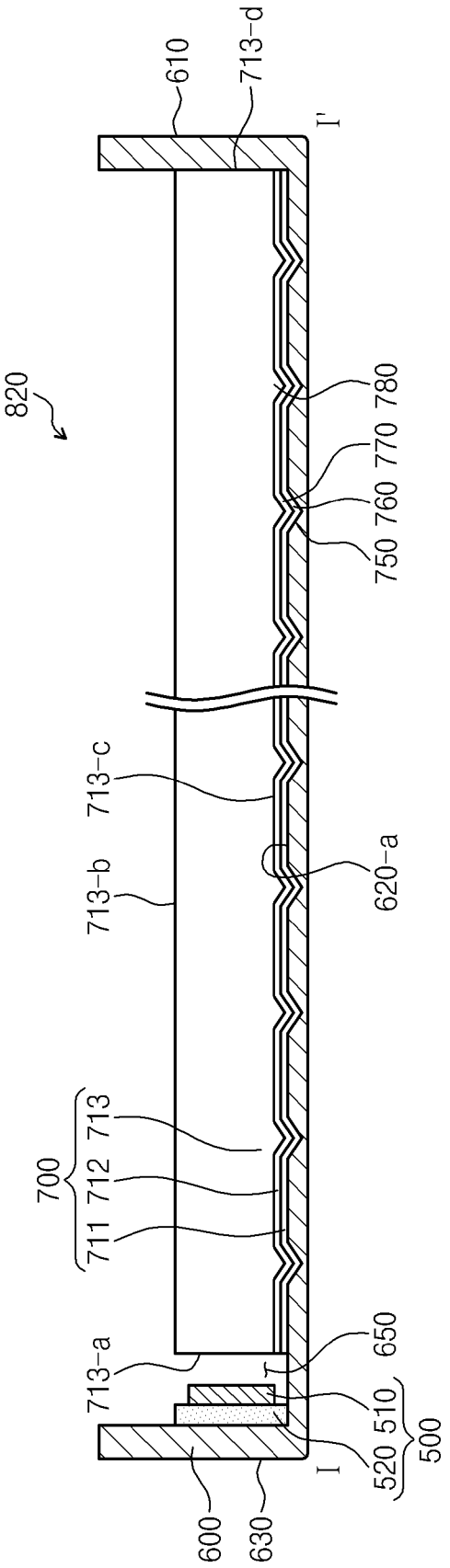
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Fig. 5

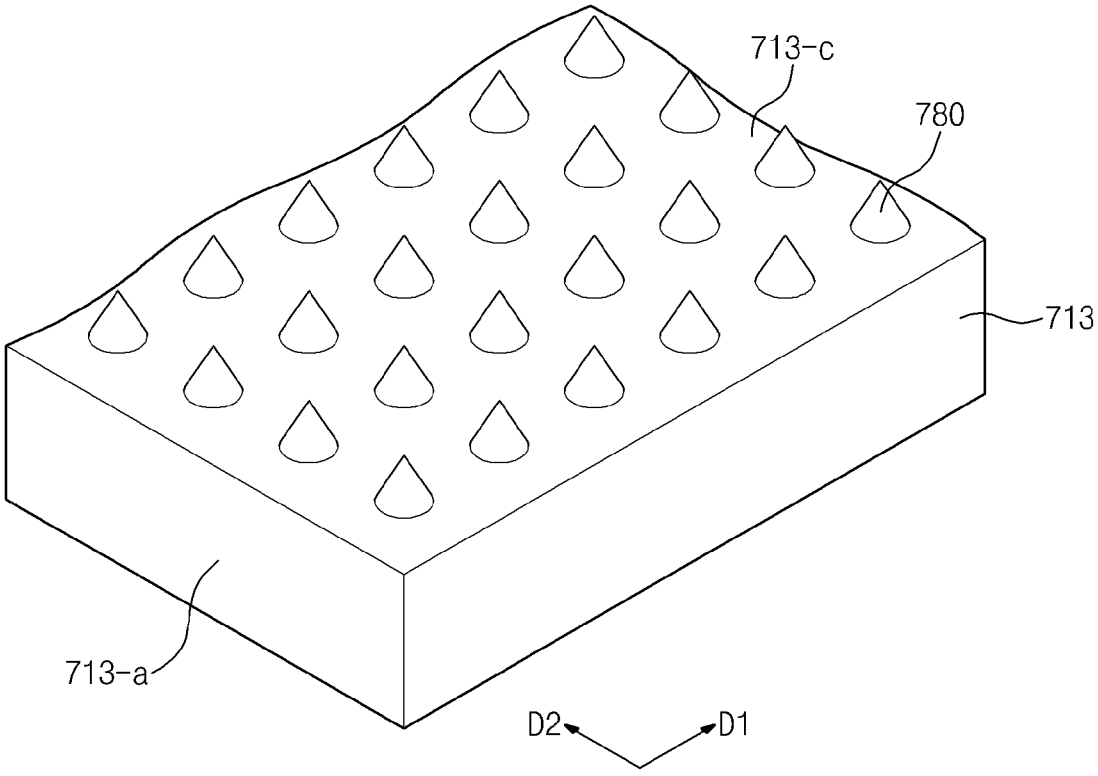

Fig. 6

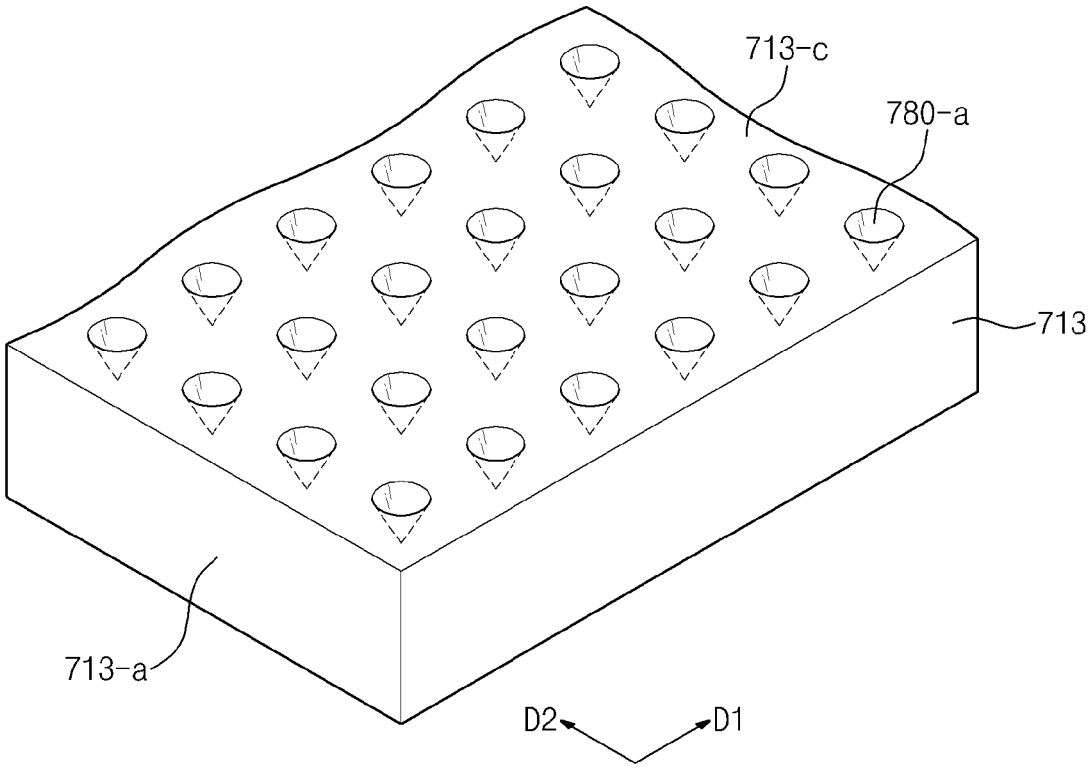

Fig. 7

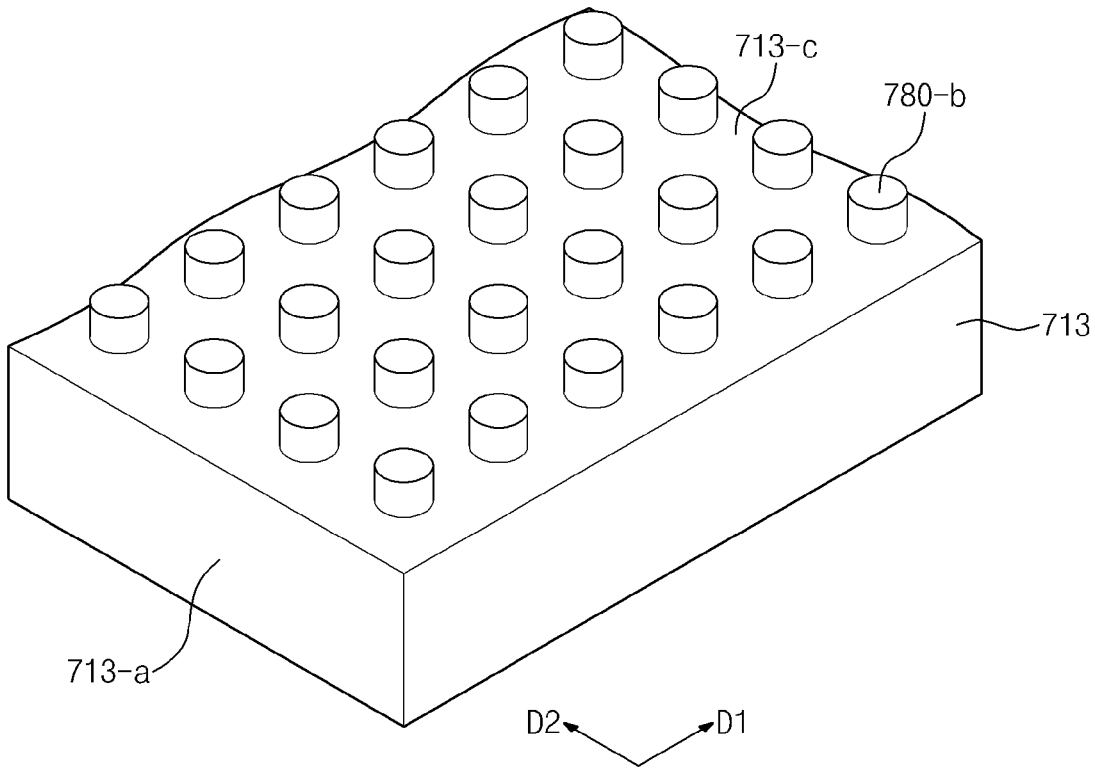

Fig. 8

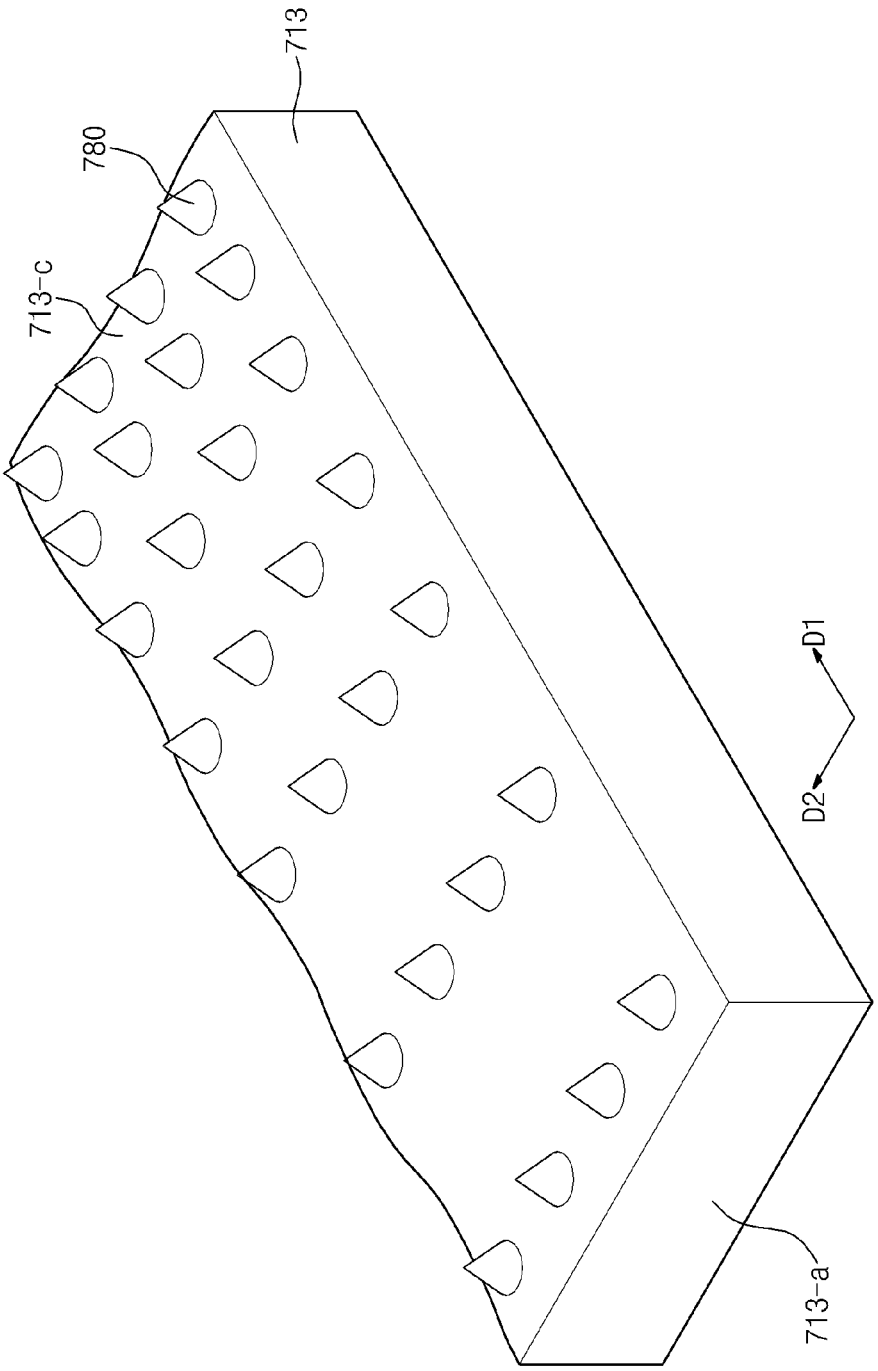

Fig. 9A

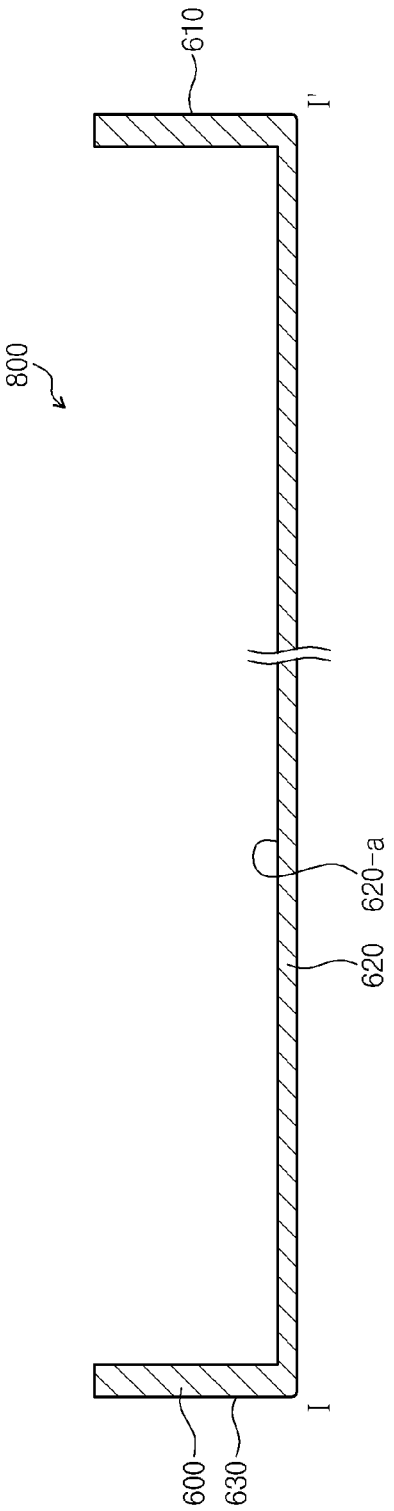

Fig. 9B

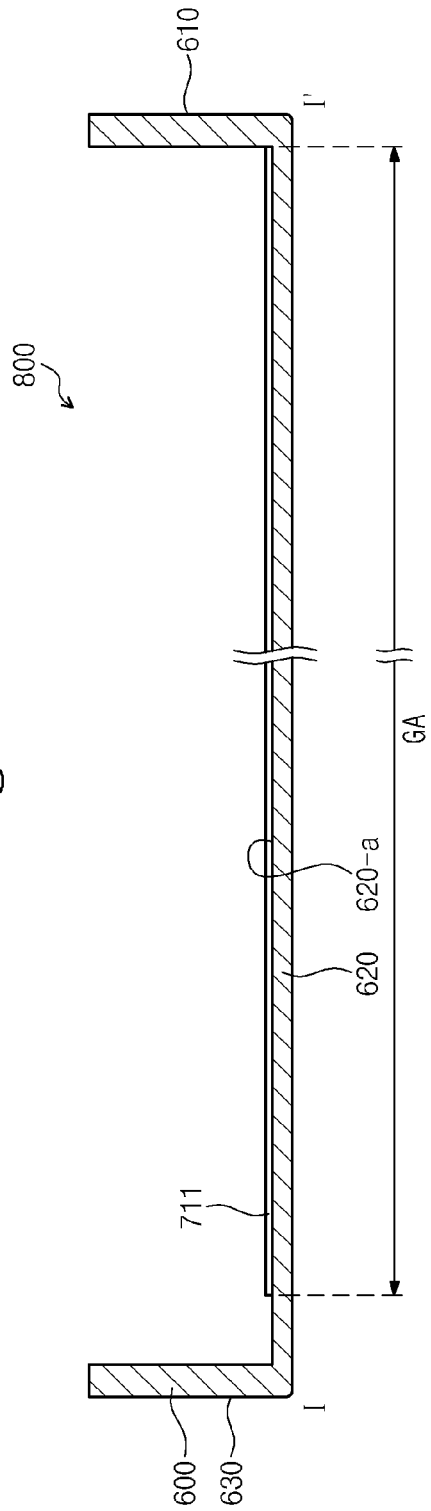

Fig. 9C

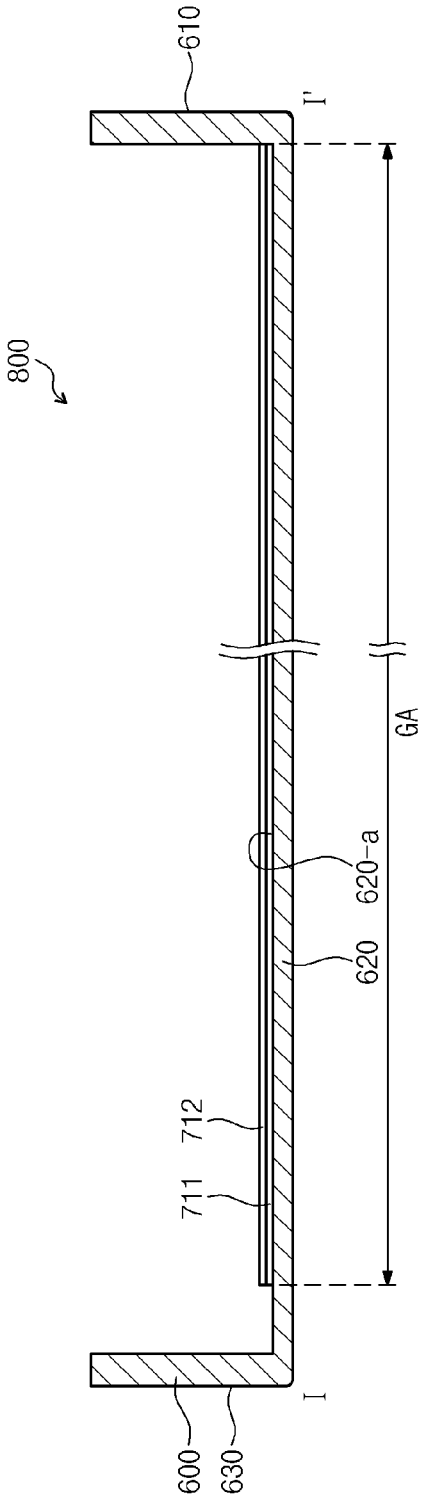
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Fig. 9D

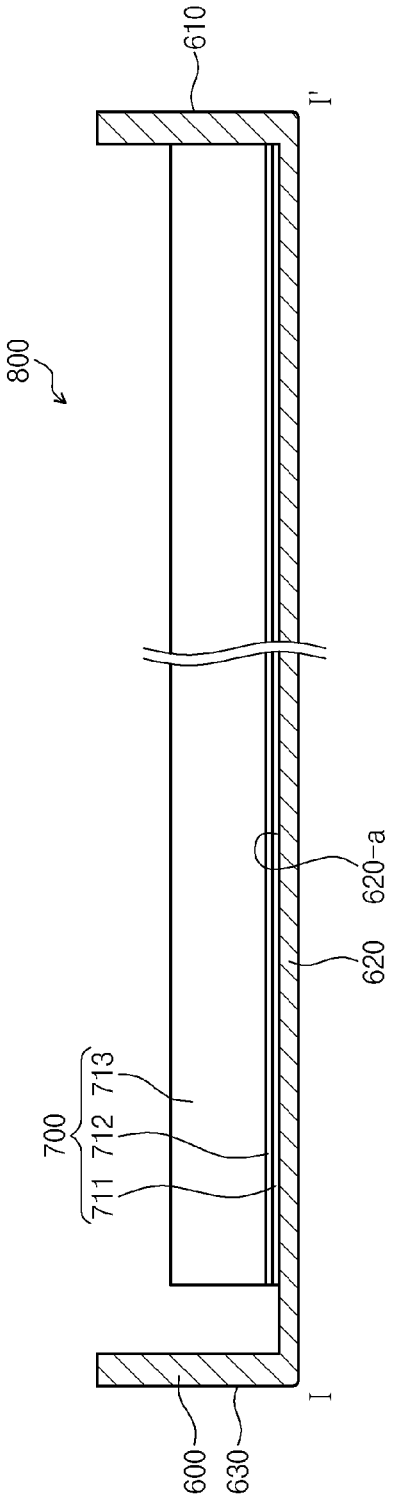
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Fig. 10A

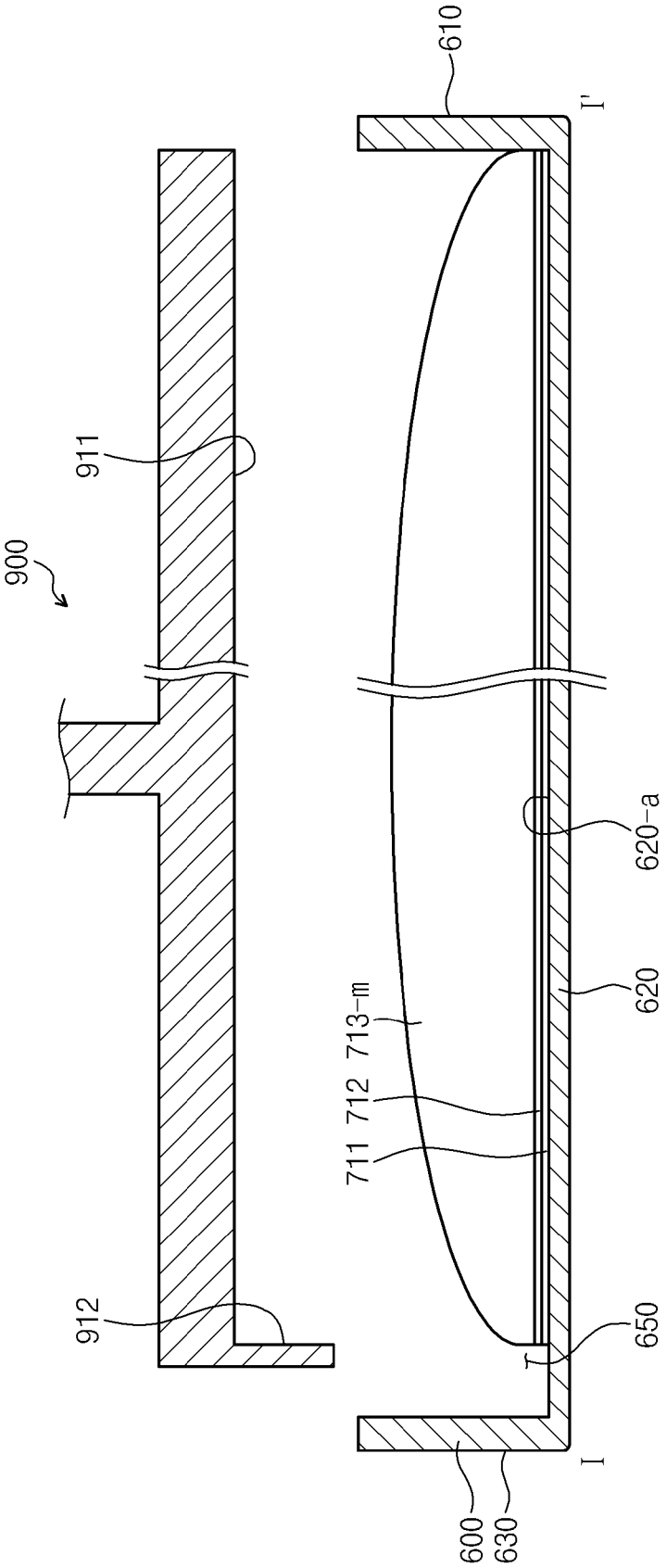

Fig. 10B

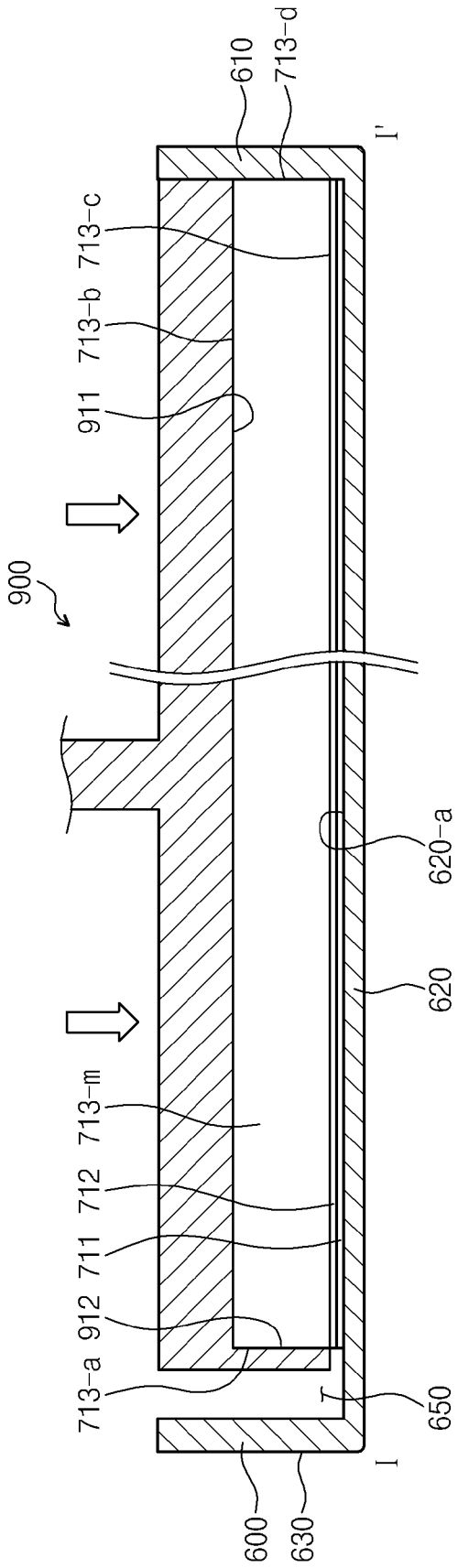
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Fig. 11A

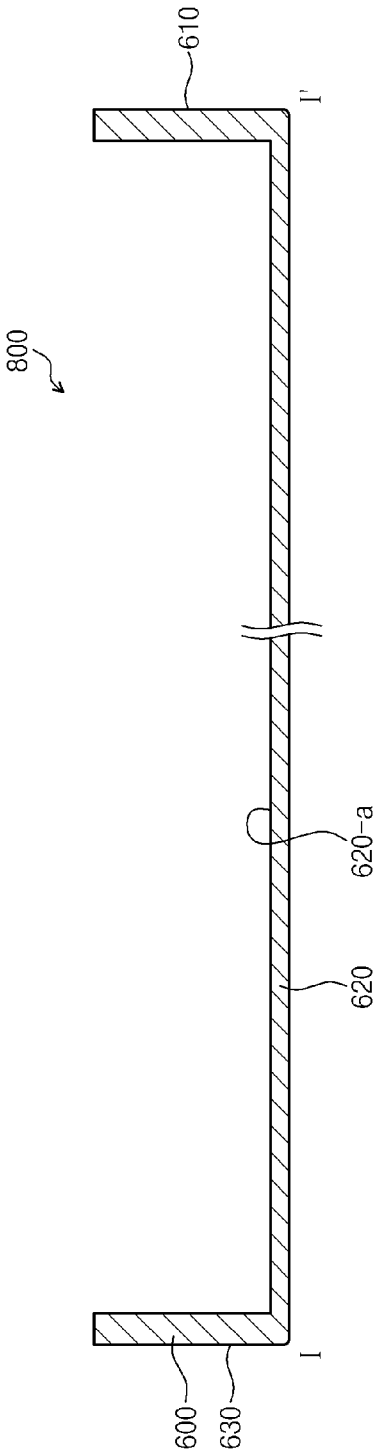

Fig. 11B

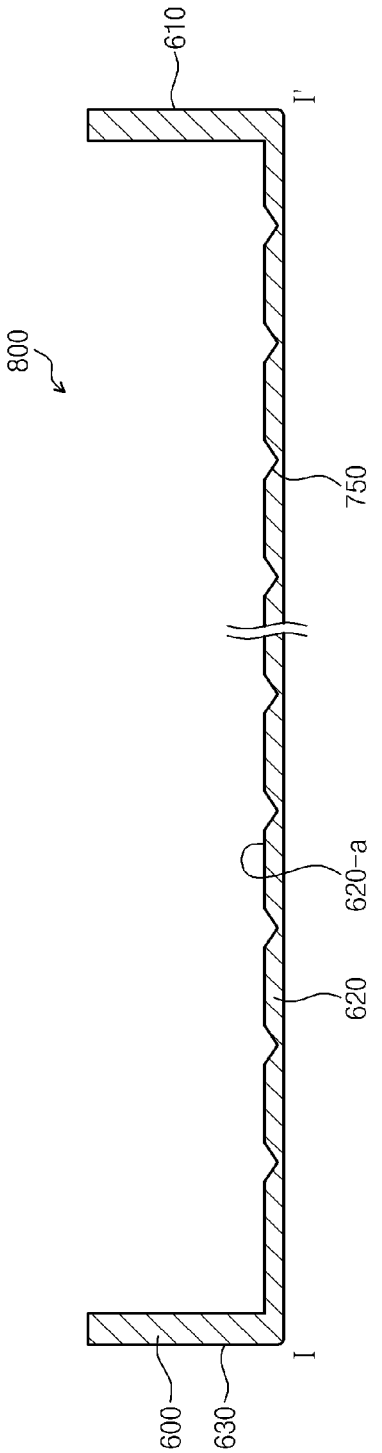

Fig. 11C

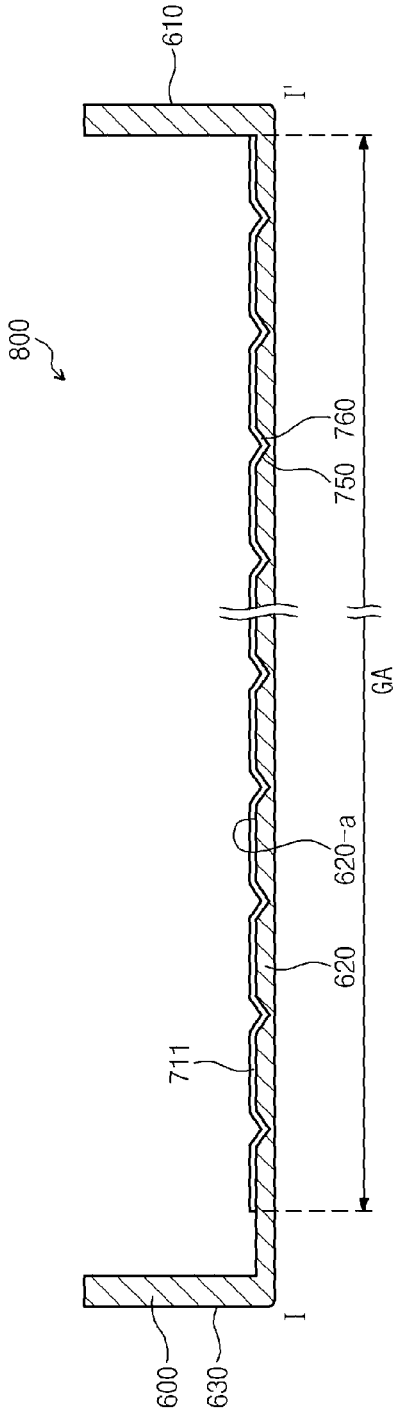

Fig. 11D

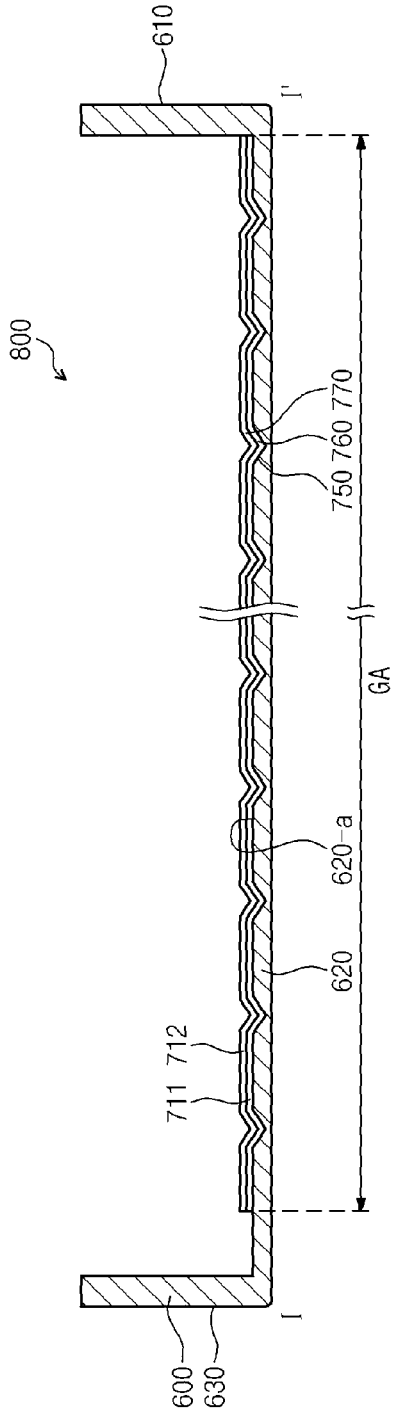

Fig. 11E

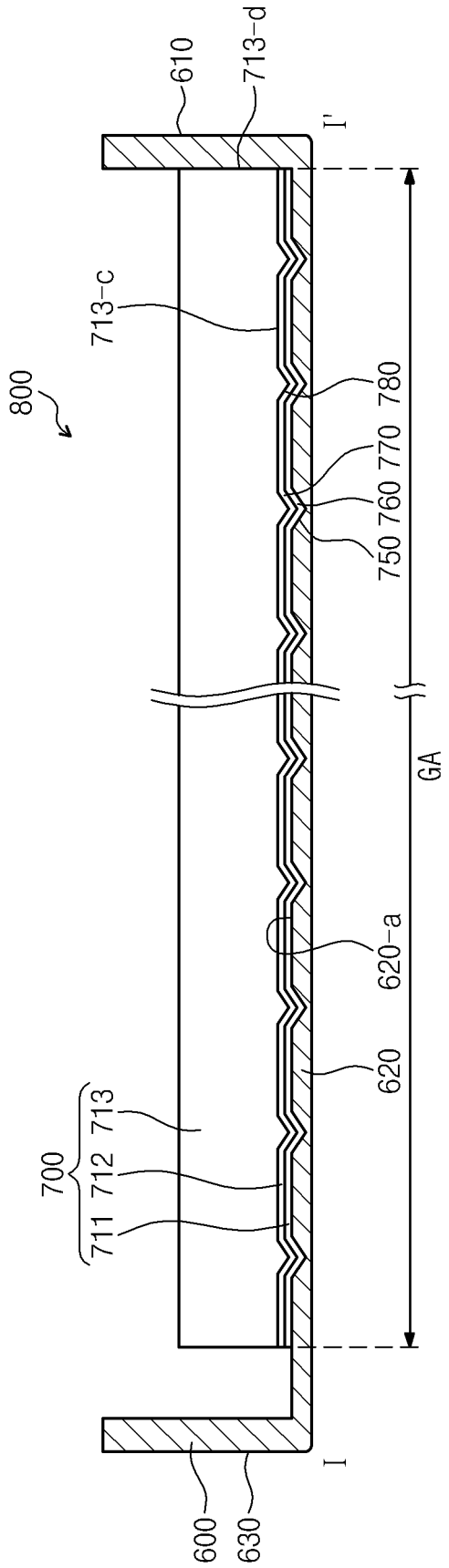
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Fig. 12A

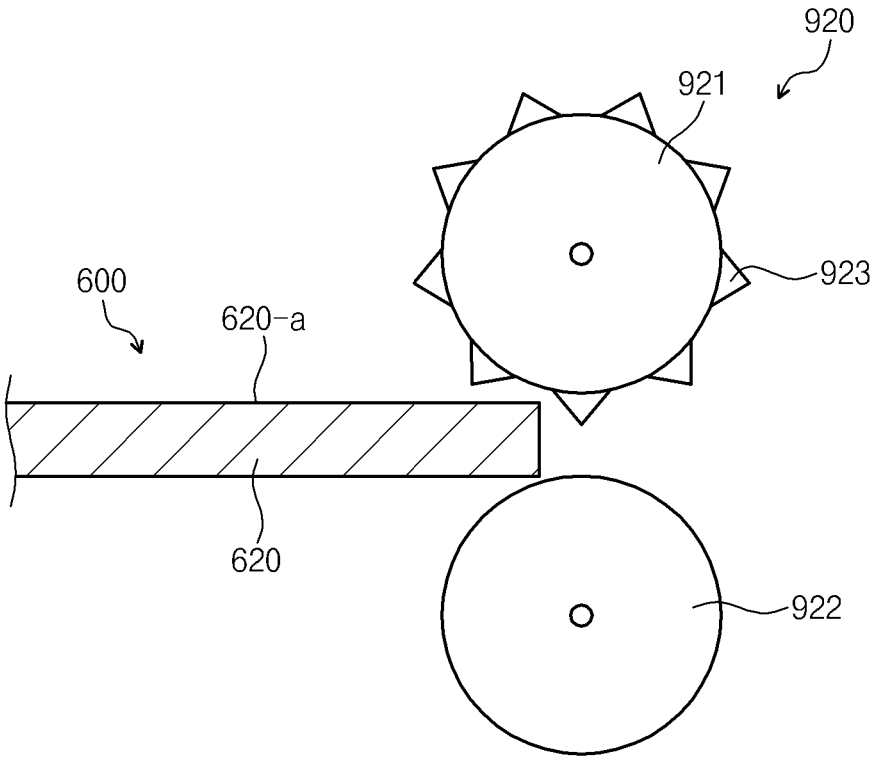


Fig. 12B

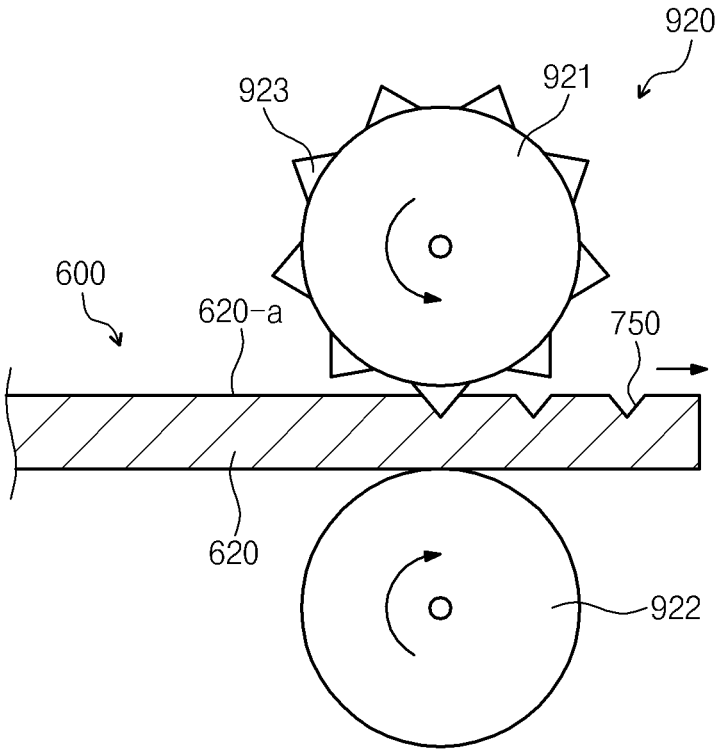


Fig. 13A

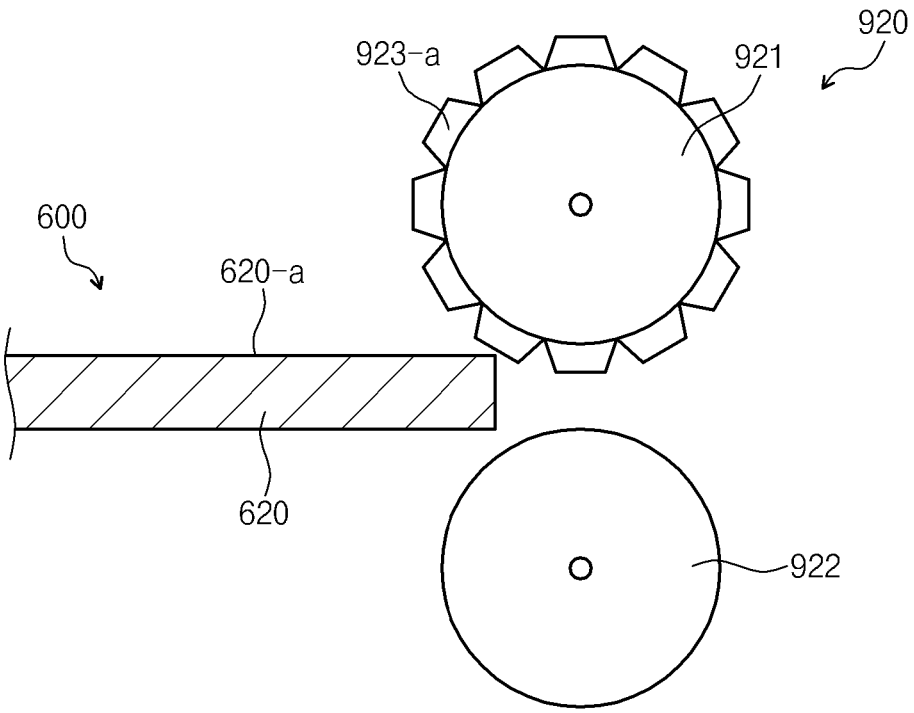


Fig. 13B

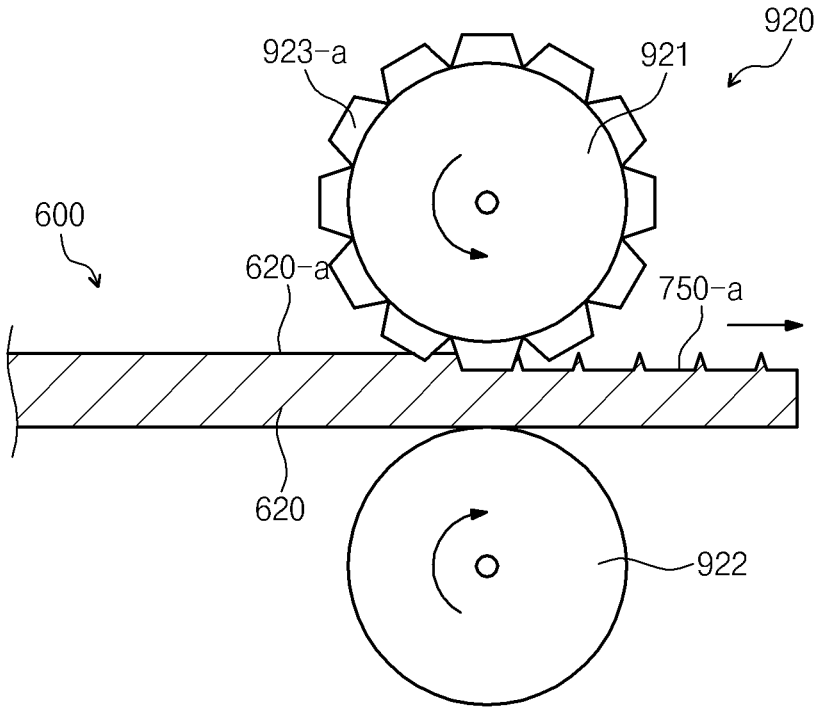


Fig. 14A

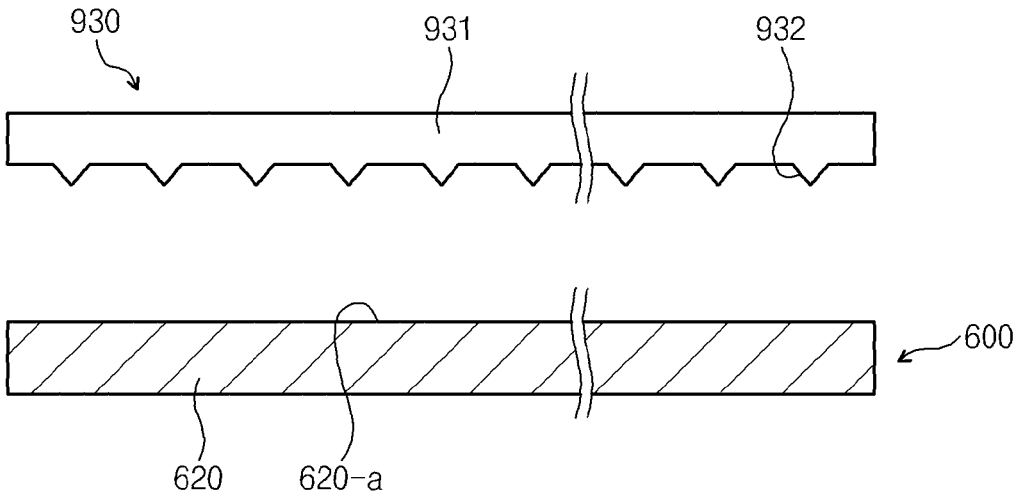


Fig. 14B

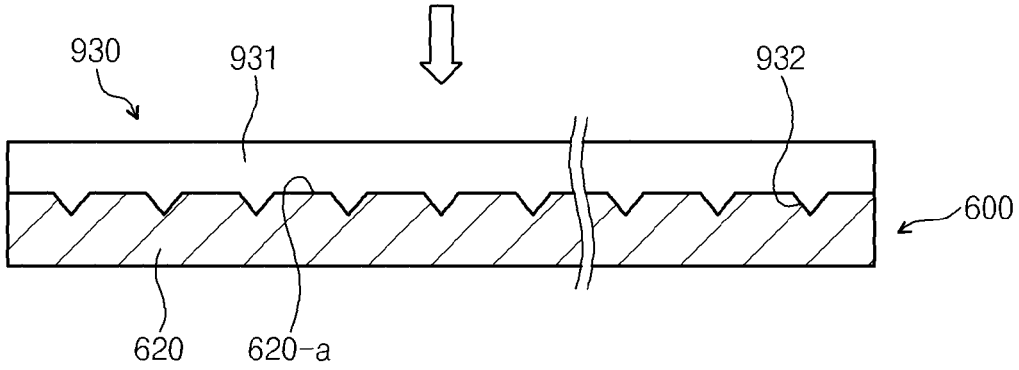


Fig. 14C

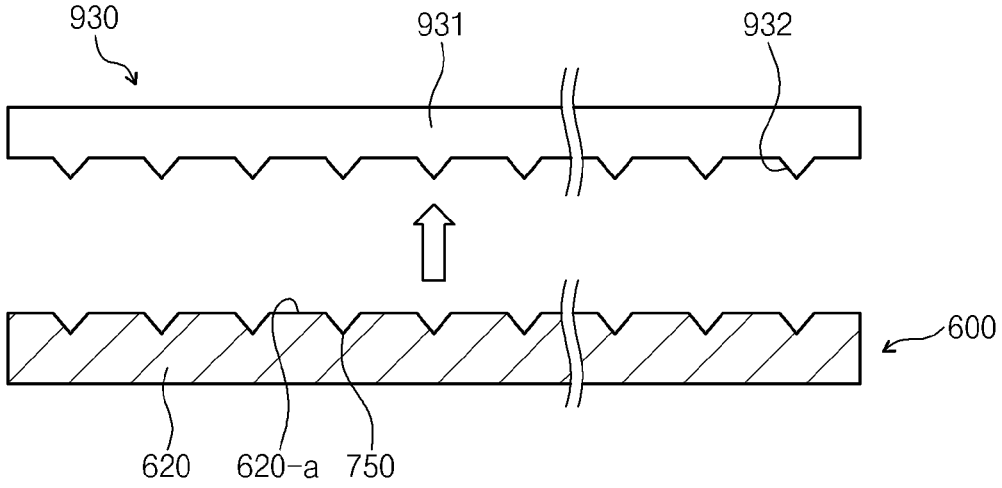


Fig. 15A

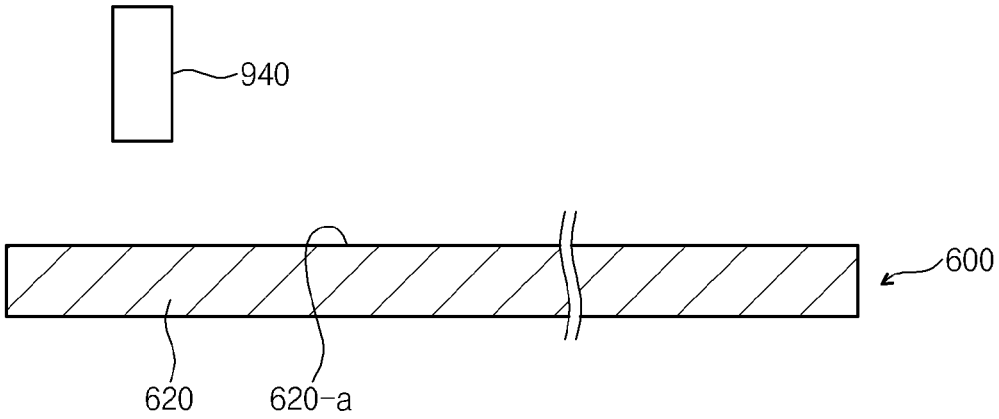
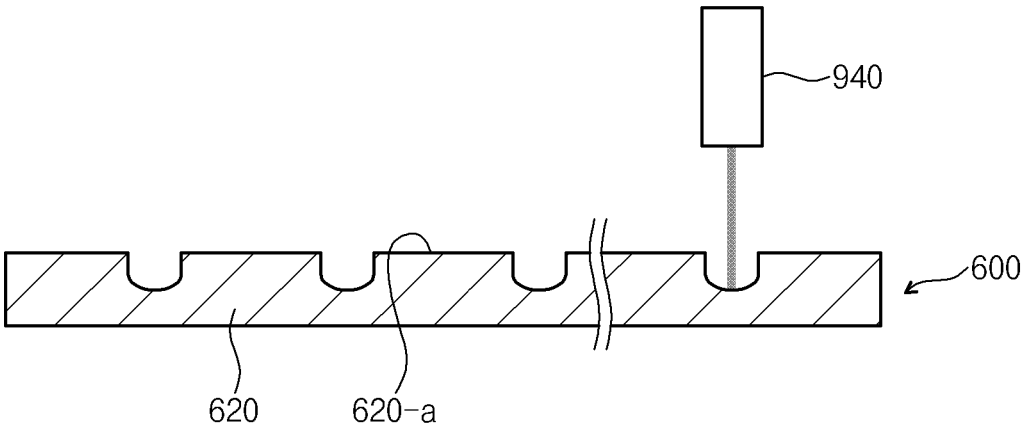


Fig. 15B



BOTTOM CHASSIS, METHOD OF MANUFACTURING THE SAME, AND DISPLAY APPARATUS INCLUDING THE SAME

This application claims priority to Korean Patent Application No. 10-2013-0089562, filed on Jul. 29, 2013, and all the benefits accruing therefrom under 35 U.S.C. §119, the contents of which are hereby incorporated by reference in its entirety.

BACKGROUND

1. Field

The invention relates to a bottom chassis, a method of manufacturing the same, and a display apparatus having the same. More particularly, the invention relates to a bottom chassis having a reduced thickness, a method of manufacturing the bottom chassis, and a display apparatus having the bottom chassis.

2. Description of the Related Art

A liquid crystal display ("LCD") includes a display panel that controls an arrangement of liquid crystal molecules in a liquid crystal layer to display an image and a backlight unit that provides a light to the display panel. The backlight unit includes a light source to emit the light, a light guide plate to guide the light provided from the light source to the display panel, and a diffusion sheet to diffuse the light exiting from the light guide plate. The light incident into the light guide plate is totally reflected at a boundary surface of the light guide plate and guided along the light guide plate. A bottom chassis accommodates the light source and a reflective sheet and protects the LCD from external impacts.

The light guide plate is manufactured by casting, extruding or injecting a plastic material with high light transmittance and high weather resistance, and placed on the bottom chassis.

SUMMARY

There is limitation to reduce a thickness of a light guide plate due to inherent properties in a manufacturing process for the light guide plate. In addition, when the light guide plate is separately manufactured and then placed on a bottom chassis, a thickness of the display apparatus is difficult to reduce.

The invention provides a bottom chassis having a reduced thickness.

The invention provides a method of manufacturing the bottom chassis.

The invention provides a display apparatus having the bottom chassis.

Exemplary embodiments of the invention provide a bottom chassis including a base chassis which accommodates a light source part which emits a light, a reflective film which is disposed on a bottom plate of the base chassis and includes a reflective material to reflect the light, a cladding film disposed on the reflective film, and a light guide film which is disposed on the cladding film, receives the light from the light source part through a first surface thereof, and guides the received light to exit through a second surface thereof as a plane light. The cladding film has a refractive index smaller than a refractive index of the light guide film.

In an exemplary embodiment, the light guide film may further include a light guide pattern disposed on a third surface facing the second surface to guide the received light to the second surface, and the first surface connects the second surface and the third surface.

In an exemplary embodiment, the bottom plate of the base chassis may include a base pattern having a concavo-convex shape and the light guide pattern has a shape corresponding to the base pattern.

In an exemplary embodiment, the reflective film and the cladding film may be sequentially stacked on the bottom plate, and each of the reflective film and the cladding films having a concavo-convex shape corresponding to the base pattern on the bottom plate has a uniform thickness.

In an exemplary embodiment, the light guide pattern may include a pattern recess recessed from the third surface to the second surface and the pattern recess has a cone shape, an elliptical cone shape, a triangular pyramid shape, a quadrangular pyramid shape, a hexagonal pyramid shape, a cylinder shape, an elliptic cylinder shape, a triangular prism shape, a square column shape, or a hexagonal column shape.

In an exemplary embodiment, the light guide pattern may include a pattern protrusion protruded from the third surface to the cladding film and the pattern protrusion has a cone shape, an elliptical cone shape, a triangular pyramid shape, a quadrangular pyramid shape, a hexagonal pyramid shape, a cylinder shape, an elliptic cylinder shape, a triangular prism shape, a square column shape, or a hexagonal column shape.

In an exemplary embodiment, the light guide film may have a thickness of about 50 micrometers to about 300 micrometers.

In an exemplary embodiment, the cladding film may have a thickness of about 10 micrometers to about 100 micrometers.

In an exemplary embodiment, the cladding film may include silicon.

In an exemplary embodiment, the bottom chassis may further include a first sidewall and a second sidewall. The bottom plate includes a first horizontal bottom plate, a second horizontal bottom plate, and an inclination bottom plate disposed between the first and second horizontal bottom plates, the inclination bottom plate is extended from an end of the first horizontal bottom plate to an end of the second horizontal bottom plate and inclined to a rear surface of the first horizontal bottom plate, the first sidewall is extended from the other end of the first horizontal bottom plate, the second sidewall extended from the other end of the second horizontal bottom plate to face the first sidewall, and the light source part is disposed on the second horizontal bottom plate.

In an exemplary embodiment, the reflective film and the cladding film may be disposed on first and second horizontal bottom plates and the inclination bottom plate and have a uniform thickness, respectively, and a width of the first surface of the light guide film in a direction vertical to the bottom plate is greater than a width of a fourth surface facing the first surface.

Exemplary embodiments of the invention provide a method of manufacturing a bottom chassis including forming a base chassis, providing a reflective material on a bottom surface of the base chassis to form a reflective film, providing a cladding material on an upper surface of the reflective film to form a cladding film, and providing a guiding material on an upper surface of the cladding film to form a light guide film. The cladding material has a refractive index smaller than a refractive index of the guiding material.

In an exemplary embodiment, the forming the base chassis may include forming a base pattern having a concavo-

convex shape on the base chassis, the forming the reflective film includes providing the reflective material on the base pattern at a uniform thickness such that the reflective film has a concavo-convex shape corresponding to the base pattern, and the forming the cladding film includes providing the cladding material on the concavo-convex shape of the reflective film at a uniform thickness such that the cladding film has a concavo-convex shape corresponding to the concavo-convex shape of the reflective film, and the forming the light guide film includes forming a light guide pattern corresponding to the concavo-convex shape on a surface thereof that contacts with the cladding film.

In an exemplary embodiment, the forming the base pattern may include aligning a laser unit along the base pattern and irradiating a laser beam on an upper surface of the base chassis using the laser unit to form the base pattern on the bottom surface of the base chassis.

In an exemplary embodiment, the forming the base pattern may include aligning an extrusion mold having a reverse shape to the base pattern on the base chassis, applying a pressure onto the extrusion mold to form the base pattern on the bottom surface of the base chassis, separating the extrusion mold from the base chassis.

In an exemplary embodiment, the forming the base pattern may include interposing the base chassis between a mold roll having a reverse shape to the base pattern and a base roll and rotating the mold roll and the base roll to form the base pattern on the bottom surface of the base chassis.

In an exemplary embodiment, the light guide film may be provided by injection-molding the guiding material using an injection mold.

Exemplary embodiments of the invention provide a display apparatus includes a light source part that emits a light, a bottom chassis that receives the light from the light source part, converts the light to a plane light, and includes a base chassis that accommodates the light source part, a reflective film disposed on a bottom plate of the base chassis and including a reflective material to reflect the light, a cladding film disposed on the reflective film, and a light guide film disposed on the cladding film, receiving the light from the light guide part through a first surface thereof, and guiding the received light to allow the light exits through a second surface thereof, and a display panel that receives the plane light from the bottom chassis to display an image. The cladding film has a refractive index smaller than a refractive index of the light guide film.

In an exemplary embodiment, the light guide film may further include a light guide pattern disposed on a third surface facing the second surface to guide the received light to the second surface, and the first surface connects the second surface and the third surface.

In an exemplary embodiment, the bottom plate of the base chassis may include a base pattern having a concavo-convex shape and the light guide pattern has a shape corresponding to the base pattern.

According to the above, the bottom chassis includes the light guide film, and thus the display apparatus does not require a separate light guide plate. Thus, the display apparatus has a simplified structure and is slimmed down.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other advantages of the invention will become readily apparent by reference to the following detailed description when considered in conjunction with the accompanying drawings, in which:

FIG. **1** is an exploded perspective view showing an exemplary embodiment of a display apparatus according to the invention;

FIG. **2** is a cross-sectional view taken along line I-I' of FIG. **1**;

FIG. **3** is a cross-sectional view showing another exemplary embodiment of a bottom chassis according to the invention;

FIG. **4** is a cross-sectional view showing another exemplary embodiment of a bottom chassis according to the invention;

FIG. **5** is a perspective view showing to an exemplary embodiment of a light guide film according the invention;

FIG. **6** is a perspective view showing another exemplary embodiment of a light guide film according to the invention;

FIG. **7** is a perspective view showing another exemplary embodiment of a light guide film according to the invention;

FIG. **8** is a perspective view showing another exemplary embodiment of a light guide film according to the invention;

FIGS. **9**A to **9**D are views showing an exemplary embodiment of a method of manufacturing a bottom chassis according to the invention;

FIGS. **10**A and **10**B are views showing another exemplary embodiment of a method of manufacturing a light guide film according to the invention;

FIGS. **11**A to **11**E are views showing another exemplary embodiment of a method of manufacturing a bottom chassis according to the invention;

FIGS. **12**A and **12**B are views showing an exemplary embodiment of a method of forming a base pattern according to the invention;

FIGS. **13**A and **13**B are views showing another exemplary embodiment of a method of forming a base pattern according to the invention;

FIGS. **14**A to **14**C are views showing another exemplary embodiment of a method of forming a base pattern according to the invention; and

FIGS. **15**A and **15**B are views showing another exemplary embodiment of a method of forming a base pattern according to the invention.

DETAILED DESCRIPTION

The invention now will be described more fully hereinafter with reference to the accompanying drawings, in which various embodiments are shown. This invention may, however, be embodied in many different forms, and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like reference numerals refer to like elements throughout.

It will be understood that when an element or layer is referred to as being "on", "connected to" or "coupled to" another element or layer, it can be directly on, connected or coupled to the other element or layer or intervening elements or layers may be present. In contrast, when an element is referred to as being "directly on," "directly connected to" or "directly coupled to" another element or layer, there are no intervening elements or layers present. Like numbers refer to like elements throughout. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

It will be understood that, although the terms first, second, etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be

limited by these terms. These terms are only used to distinguish one element, component, region, layer or section from another region, layer or section. Thus, a first element, component, region, layer or section discussed below could be termed a second element, component, region, layer or section without departing from the teachings of the invention.

Spatially relative terms, such as "beneath", "below", "lower", "above", "upper" and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "below" or "beneath" other elements or features would then be oriented "above" the other elements or features. Thus, the exemplary term "below" can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

The terminology used herein is for the purpose of describing particular exemplary embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms, "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "includes" and/or "including", when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

"About" or "approximately" as used herein is inclusive of the stated value and means within an acceptable range of deviation for the particular value as determined by one of ordinary skill in the art, considering the measurement in question and the error associated with measurement of the particular quantity (i.e., the limitations of the measurement system). For example, "about" can mean within one or more standard deviations, or within ±30%, 20%, 10%, 5% of the stated value.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

Hereinafter, the invention will be explained in detail with reference to the accompanying drawings.

FIG. **1** is an exploded perspective view showing a display apparatus according to an exemplary embodiment of the invention.

Referring to FIG. **1**, a liquid crystal display ("LCD") **1000** includes a top chassis **100**, a display panel **200**, a mold frame **300**, an optical member **400**, a light source part **500**, and a bottom chassis **800**.

The display panel **200** includes an array substrate **220**, an opposite substrate **210** facing the array substrate **220** while being coupled to the array substrate **220**, and a liquid crystal layer (not shown) interposed between the array substrate **220** and the opposite substrate **210**.

The array substrate **220** may be, but not limited to, a thin film transistor substrate on which thin film transistors that serve as a switching device are arranged in a matrix form. Each thin film transistor includes a source electrode connected to a data line, a gate electrode connected to a gate line, and a drain electrode connected to a pixel electrode including a transparent conductive material.

The opposite substrate **210** includes an RGB color filter to display colors, a black matrix, and a common electrode including a transparent conductive material.

The LCD **1000** includes a printed circuit board ("PCB") **230** including a timing controller to apply a data driving signal and a gate driving signal and a driving circuit film **240** to connect the PCB **230** to the display panel **200**.

In an exemplary embodiment, the driving circuit film **240** may be a tape carrier package ("TCP") on which a driving chip is mounted or a chip on film ("COF") package.

The driving chip includes a data driver that applies a data signal to the display panel **200** in response to the data driving signal. In addition, a gate driver that applies a gate signal to the display panel **200** in response to the gate driving signal may be disposed (e.g., built) in the display panel **200** through a thin film process.

The mold frame **300** is disposed between the optical member **400** and the display panel **200**. The mold frame **300** is coupled to the bottom chassis **800** to fix the optical member **400** to the bottom chassis **800** and effectively prevents the optical member **400** from moving.

In addition, the mold frame **300** supports the display panel **200**. In detail, the mold frame **300** further includes a panel guide part **310** to guide the display panel **200** placed on the panel guide part **310**.

The top chassis **100** faces the mold frame **300** while being coupled to the mold frame **300**, and the top chassis **100** fixes the display panel **200** to the mold frame **300**. The top chassis **100** covers an edge of the display panel **200** while fixing the display panel **200** to the mold frame **300**. Accordingly, the top chassis **100** effectively prevents the display panel **200** from being damaged due to external impacts and from being separated from the mold frame **300**.

The optical member **400** includes optical sheets **410**, **420**, and **430**.

The optical sheets **410**, **420**, and **430** includes one diffusion sheet **430** to diffuse the light provided from the bottom chassis **800** and two prism sheets **410** and **420** to collect the diffused light, thereby improving a brightness characteristic of the light provided from the bottom chassis **800**.

The diffusion sheet **430** diffuses the light provided from the bottom chassis **800**. In an exemplary embodiment, the diffusion sheet **430** includes a transparent material, e.g., polyethylene terephthalate ("PET"). However, the invention is not limited thereto, and the diffusion sheet **430** may include various other types of transparent materials.

The prism sheets **410** and **420** are disposed on the diffusion sheet **430** and collect the light diffused by the diffusion sheet, thereby improve a front brightness. Each of the prism sheets **410** and **420** includes a prism pattern (not shown) having a prism shape. In an exemplary embodiment, one of the prism sheets **410** and **420** includes the prism pattern extended in a first direction and the other of the prism sheet **410** and **420** includes the prism pattern extended in a second direction substantially perpendicular to the first direction.

The light source part **500** is accommodated in the bottom chassis **800**. The light source part **500** provides the light to the bottom chassis **800**. The light source part **500** includes a circuit board **520** and a plurality of light sources **510**

disposed (e.g., mounted) on the circuit board **520**. In an exemplary embodiment each of the light sources **510** may include a light emitting diode ("LED") that emits a white light. However, the invention is not limited thereto, and the diffusion sheet **430** may include various other types of light sources emitting various other colors.

FIG. **2** is a cross-sectional view taken along line I-I' of FIG. **1**.

Referring to FIG. **2**, the bottom chassis **800** includes a base chassis **600** and a light converting part **700**. The light converting part **700** includes a reflective film **711**, a cladding film **712** and a light guide film **713**.

The base chassis **600** includes a bottom plate **620** having a rectangular shape, and first, second, third and fourth sidewalls **610**, **630**, **611**, and **631** extended from the bottom plate **620**. The first and second sidewalls **610** and **630** face each other and the third and fourth sidewalls **611** and **631** face each other. In an exemplary embodiment, the base chassis **600** may include an aluminum-based metal, for example, to easily discharge heat generated from the light source part **500**. However, the invention is not limited thereto, and the base chassis **600** may include various other types of materials.

The reflective film **711** is disposed on a bottom surface **620**-*a* of the bottom plate **620** of the base chassis **600**, the cladding film **712** is disposed on the reflective film **711**, and the light guide film **713** is disposed on the cladding film **712**. In an exemplary embodiment, the reflective film **711** and the cladding film **712** are provided by a coating method, and the light guide film **713** is provided by coating a guiding material on the cladding film **712**. A manufacturing process of the bottom chassis **600** will be described in detail later.

The bottom chassis **600** provides a light source receiving part **650** defined by a side surface, a bottom surface of the light converting part **700** and the second sidewall **630**, and the light source part **500** is accommodated in the light source receiving part **650**. The light source part **500** is disposed (e.g., accommodated) in the light source receiving part **650** and attached to the second sidewall **630** to allow a light exit surface thereof to face the light guide film **713**.

The light guide film **713** receives the light from the light source part **500** and guides the light to the optical member **400**. The light guide film **713** includes first, second, and third surfaces **713**-*a*, **713**-*b*, and **7143**-*c*. The first surface **713**-*a* faces the light exit surface of the light source part **500** and receives the light from the light source part **500**. The second surface **713**-*b* faces the optical member **400** and the light incident to the first surface **713**-*a* exits through the second surface **713**-*b* as a plane light. The third surface **713**-*c* is substantially parallel to the second surface **713**-*b*, makes contact with an upper surface of the cladding film **712**, and guides the light incident through the first surface **713**-*a* to the second surface **713**-*b*. In an exemplary embodiment, the first surface **713**-*a* may be one of side surfaces used to connect the second surface **713**-*b* and the third surface **713**-*c*. In an exemplary embodiment, the light guide film **713** includes a resin with high light transmittance and high weather resistance, e.g., polymethylmethacrylate ("PMMA").

The cladding film **712** totally reflects the light traveling to the cladding film **712** in the light guide film **713** to the light guide film **713**. In an exemplary embodiment, the cladding film **712** includes a material with a refractive index lower than that of the light guide film **713**, preferably the cladding film **712** has the refractive index approximate to a refractive index of air, e.g., about 0. In an exemplary embodiment, when the light guide film **713** includes PMMA having a refractive index of about 1.49, the cladding film **712** includes silicon having a refractive index of about 1.2. Thus, when the light incident into the light guide film **713** and reaching to an interface, i.e., the third surface **713**-*c*, between the light guide film **713** and the cladding film **712** has an angle greater than a critical angle, the light is totally reflected by the third surface **713**-*c* to travel back to the inside of the light guide film **713**. In this case, the critical angle is defined by an angle between a normal line of the third surface **713**-*c* and a direction in which the incident light travels. The light incident into the light guide film **713** from the light source part **500** may be totally reflected by the cladding film **712** in the light guide film **713**.

The reflective film **711** reflects the light leaked from the cladding film **712** and not totally reflected by the cladding film **712** to allow the leaked light to travel back to the cladding film **712**. In an exemplary embodiment, the reflective film **711** includes a resin material having high reflectance, e.g., polyethylene terephthalate, polycarbonate ("PC"), etc. Therefore, the light leaked from the cladding film **712** is reflected by the reflective film **711** and travels back to the light guide film **713**. The reflective film **711** regularly or irregularly reflects the light incident thereto to the light guide film **713**.

As described above, since the light guide film **713** is directly disposed on the base chassis **600** in a film form, a total thickness of the display apparatus may be effectively reduced. In addition, the display apparatus may be simply assembled, and thus defects occurring when the display apparatus is assembled may be effectively reduced and the time required to assemble the display apparatus may be shortened.

FIG. **3** is a cross-sectional view showing a bottom chassis according to another exemplary embodiment of the invention.

Referring to FIG. **3**, a bottom chassis **810** includes a base chassis **600**, a reflective film **711**, a cladding film **712**, and a light guide film **713**.

The base chassis **600** includes a first sidewall **610**, a second sidewall **630**, and a bottom plate **620**. The bottom plate **620** includes a first horizontal bottom plate **621**, a second horizontal bottom plate **623**, and an inclination bottom plate **622**. In detail, the first sidewall **610** is extended from one end of the first horizontal bottom plate **621** and the second sidewall **630** is extended from one end of the second horizontal bottom plate **623**. The inclination bottom plate **622** is disposed between the first and second horizontal bottom plates **621** and **623** to connect the first and second horizontal bottom plates **621** and **623**. In particular, the inclination bottom plate **622** is inclined downward from the first horizontal bottom plate **621** and extended to the second horizontal bottom plate **623**.

The light source part **500** is disposed in the light source receiving part **650** and attached to the second sidewall **630** to allow the light exit surface thereof to face the light guide film **713**. A first height **610**-*h* defined by a length between an upper end of the first sidewall **610** and a rear surface of the first horizontal bottom plate **621** is smaller than a second height **630**-*h* defined by a length between an upper end of the second sidewall **630** and a rear surface of the second horizontal bottom plate **623**.

The reflective film **711** and the cladding film **712** are sequentially disposed on the first horizontal bottom plate **621** and the inclination bottom plate **622** to have a uniform thickness and have a shape corresponding to that of the base chassis **600**. The light guide film **713** is disposed on the cladding film **712** and the third surface **713**-*c* has a shape corresponding to that of the cladding film **712**. The second

surface **713**-*b* is substantially parallel to the first horizontal bottom plate **621** such that a first thickness **713**-h**1** at the first surface **713**-*a*, i.e., a light incident portion, is thicker than a second thickness **713**-h**2** at a fourth surface **713**-*d*, i.e., an opposite portion, facing the first surface **713**-*a*. Thus, the light guide film **713** has a tapered shape in the light incident portion.

As described above, when a portion of the bottom plate **620** is inclined, the light guide film **713** has the tapered shape. Due to the tapered shape, the light guide film **713** has a relatively thin thickness on the first horizontal bottom plate **621** and has a relatively thick thickness on the second horizontal bottom plate **623**. In this case, the light exit surface of the light source **510** may be increased to correspond to the first thickness **713**-h**1**. Therefore, when the display apparatus employs the light guide film **713** having the tapered shape, the amount of the light incident into the light guide film **713** from the light source part **500** is increased, and thus the brightness of the display apparatus may be enhanced.

FIG. **4** is a cross-sectional view showing a bottom chassis according to another exemplary embodiment of the invention.

Referring to FIG. **4**, a bottom chassis **820** includes a base chassis **600**, a reflective film **711**, a cladding film **712** and a light guide film **713**.

The base chassis **600** includes a bottom surface **620**-*a* and a base pattern provided in the bottom surface **620**-*a* to have a concavo-convex shape. The base pattern is defined by first recesses **750** recessed from the bottom surface **620**-*a* of the bottom plate **620** and spaced apart from each other at a predetermined interval.

The reflective film **711** is disposed on the bottom surface **620**-*a* of the base chassis **600** and has a concavo-convex shape corresponding to the base pattern. The reflective film **711** is provided along the base pattern to have a uniform thickness. The reflective film **711** includes second recesses **760** recessed to the base chassis **600**, and the second recesses **760** are positioned at positions to respectively correspond to the first recesses **750**. Accordingly, the reflective film **711** has the concavo-convex shape corresponding to the base pattern.

The cladding film **712** is disposed on the reflective film **711** and has a concavo-convex pattern corresponding to the base pattern. The cladding film **712** is provided along the concavo-convex shape of the reflective film **711** to have a uniform thickness. The cladding film **712** includes third recesses **770** recessed to the reflective film **711**, and the third recesses **770** are positioned at positions to respectively correspond to the second recesses **760**. Accordingly, the cladding film **712** has the concavo-convex shape corresponding to the base pattern.

The light guide film **713** is disposed on the cladding film **712** and includes a light guide pattern having a shape corresponding to the base pattern. The light guide film **713** includes a second surface **713**-*b* from which the light exits and a third surface **713**-*c* making contact with the cladding film **712**. The second surface **713**-*b* is provided to be substantially parallel to the bottom surface **620**-*a* and the third surface **713**-*c* includes the light guide pattern. The light guide pattern has a shape corresponding to the concavo-convex shape of the cladding film **712** and includes pattern protrusions **780** protruded from the third surface **713**-*c* to the cladding film **712**. The pattern protrusions **780** are engaged with the third recesses **770** and have the shape corresponding to that of the third recesses **770**. Therefore, the pattern protrusions **780** form the light guide pattern corresponding to the base pattern.

As described above, the first, second, and third recesses **750**, **760**, and **770** and the pattern protrusions **780** have the shape corresponding to that of the base pattern. The light incident into the light guide film **713** through the first surface **713**-*a* is guided by the light guide pattern of the third surface **713**-*c* and exits through the second surface **713**-*b*. In detail, the light incident to the first surface **713**-*a* is guided along the light guide film **713** and reflected, refracted, or scattered by the pattern protrusions **780**, and thus the light exits through the second surface **713**-*b* in a plane light shape. Accordingly, the bottom chassis **820** may provide the plane light to the optical member **400**.

FIG. **5** is a perspective view showing a light guide film according to an exemplary embodiment of the invention, FIG. **6** is a perspective view showing a light guide film according to another exemplary embodiment of the invention, FIG. **7** is a perspective view showing a light guide film according to another exemplary embodiment of the invention, and FIG. **8** is a perspective view showing a light guide film according to another exemplary embodiment of the invention. FIGS. **6** to **8** show various light guide patterns disposed on the third surface **713**-*c* of the light guide film **713**.

A light guide pattern guides the light provided from the light source part **500** to allow the plane light to exit through the second surface **713**-*b* of the light guide film **713**. In detail, the light guide pattern includes the pattern protrusions **780** to reflect, refract, or scatter the light incident through the first surface **713**-*a* to the second surface **713**-*b*. As a result, the light, which is reflected, refracted, or scattered to the second surface **713**-*b*, is incident to the second surface **713**-*b* at an angle smaller than the critical angle and exits through the second surface **713**-*b* without being totally reflected.

The pattern protrusions **780** of the light guide pattern may have various shapes in order to travel the light toward the second surface **713**-*b*. In an exemplary embodiment, referring to FIG. **5**, the third surface **713**-*c* includes the light guide pattern configured to include the pattern protrusions **780**. Each pattern protrusion **780** has a cone shape, but it should not be limited to the cone shape. In another exemplary embodiment, the light guide pattern may be a pattern recess **780**-*a* recessed from the third surface **713**-*c* to the second surface **713**-*b* to have the cone shape as shown in FIG. **6**. In addition, in another exemplary embodiment, the light guide pattern may be a pattern protrusion **780**-*b* having a cylinder shape as shown in FIG. **7**. Further, in other exemplary embodiments, the pattern protrusion **780** may have various types of shapes such as an elliptical cone shape, a triangular pyramid shape, a quadrangular pyramid shape, a hexagonal pyramid shape, an elliptic cylinder shape, a triangular prism shape, a square column shape, or a hexagonal column shape, for example.

Referring to FIG. **5**, the pattern protrusions **780** are arranged on the third surface **713**-*c* in a two-dimensional matrix form. In detail, the pattern protrusions **780** are spaced apart from each other at a predetermined distance in a square array along the first and second directions D1 and D2, but they should not be limited thereto or thereby. In an exemplary embodiment, the distance between the pattern protrusions **780** becomes narrow along the first direction D1 as shown in FIG. **8** in order to provide the uniform plane light to the second surface **713**-*b*. In addition, according to another exemplary embodiment, the pattern protrusions **780** are configured to include grooves each having a line shape.

FIGS. **9**A to **9**D are views showing a method of manufacturing a bottom chassis according to an exemplary embodiment of the invention.

Referring to FIGS. **9**A to **9**D, the method of manufacturing the bottom chassis **800** includes forming the base chassis **600**, forming the reflective film **711**, forming the cladding film **712** and forming the light guide film **713**.

FIG. **9**A shows the forming of the base chassis **600**. Referring to FIG. **9**A, the base chassis **600** is provided to include the bottom plate **620** and the first and second sidewalls **610** and **630**. The base chassis **600** may be provided by a rolling method, a forge welding method, or a casting method. In an exemplary embodiment, the base chassis **600** includes a material having high strength, e.g., aluminum, stainless steel, etc., and the bottom plate **620** has a thickness of about 0.5 millimeters (mm).

FIG. **9**B shows the forming of the reflective film **711**. Referring to FIG. **9**B, the reflective film **711** is provided in a film area GA of the bottom surface **620**-*a* of the base chassis **600**. In an exemplary embodiment, the reflective film **711** is provided by laminating a reflective material on the bottom surface **620**-*a*. The reflective material has high reflectance with respect to the light and is provided by using the resin, such as PC or PET. The reflective film **711** has a uniform thickness of about 0.2 mm and an upper surface of the reflective film **711** is substantially parallel to the bottom surface **620**-*a*.

FIG. **9**C shows the forming of the cladding film **712**. Referring to FIG. **9**C, the cladding film **712** is disposed on the reflective film **711** in the film area GA. In an exemplary embodiment, the cladding film **712** is provided by laminating a cladding material disposed (e.g., coated) on the upper surface of the reflective film **711**. The cladding material has the refractive index smaller than a refractive index of a guiding material of the light guide film **713**. In an exemplary embodiment, the cladding film **712** has a uniform thickness of about 10 micrometers (μm) to about 100 μm and an upper surface of the cladding film **712** is substantially parallel to the bottom surface **620**-*a*.

FIG. **9**D shows the forming of the light guide film **713**. Referring to FIG. **9**D, the light guide film **713** is disposed on the cladding film **712** in the film area GA. In an exemplary embodiment, the light guide film **713** is coated on the upper surface of the cladding film **712** by laminating the guiding material disposed on the upper surface of the cladding film **712**. In an exemplary embodiment, the guiding material includes PMMA with high light transmittance and high weather resistance. In an exemplary embodiment, the light guide film **713** has a uniform thickness of about 0.2 mm and an upper surface of the light guide film **713** is substantially parallel to the bottom surface **620**-*a*. In particular, since light converting part **700** including the reflective film **711**, the cladding film **712** and the light guide film **713** is directly disposed on the base chassis **600**, the thickness of the light guide film **713** may be effectively reduced.

Consequently, a bottom chassis, a reflective plate, and a light guide plate of a conventional liquid crystal display, which are assembled to each other after being separately manufactured, are replaced with the base chassis **600**, the reflective film **711**, the cladding film **712** and the light guide film **713**, which are integrally provided with each other, and thus the manufacturing process of the LCD may be simplified. Therefore, defects occurring when the LCD is assembled may be effectively reduced, the time required to assemble the LCD may be shortened, and a manufacturing cost of the LCD may be effectively reduced. In addition, the thickness of the light guide film **713** is about 50 μm to about 300 μm, and thus the total thickness of the LCD may be effectively reduced.

FIGS. **10**A and **10**B are views showing a method of manufacturing a light guide film according to another exemplary embodiment of the invention. Referring to FIGS. **10**A and **10**B, the method of manufacturing the light guide film includes providing the guiding material and pressing the guiding material.

FIG. **10**A shows the providing of the guiding material. Referring to FIG. **10**A, the guiding material **713**-*m* is coated on the cladding film **712**. A surface of the coated guiding material **713**-*m* may have a convex shape due to a surface tension. An amount of the guiding material **713**-*m* coated on the cladding film **712** is determined depending on the thickness of the light guide film **713**, to be formed. Accordingly, when the amount of the guiding material **713**-*m* is decreased, the thickness of the light guide film **713** becomes thin, and when the amount of the guiding material **713**-*m* is increased, the thickness of the light guide film **713** becomes thick.

FIG. **10**B shows the pressing of the guiding material. Referring to FIG. **10**B, the coated guiding material **713**-*m* is injection-molded by an injection mold **900**. The injection mold **900** is disposed on the coated guiding material **713**-*m* and descended to the guiding material **713**-*m* to press the guiding material **713**-*m*. The injection mold **900** includes a first molding surface **911** and a second molding surface **912** to mold the guiding material **713**-*m* into the light guiding film **713**. When the injection mold **900** is descended, the first molding surface **911** presses the upper portion of the guiding material **713**-*m* to the bottom surface **620**-*a*. The second molding surface **912** effectively prevents the guiding material **713**-*m* from moving to the second sidewall **630** while the first molding surface **911** presses the guiding material **713**-*m*. Accordingly, a space is defined between the second sidewall **630** of the bottom chassis **600** and the light guide film **713**, and the space serves as the light source receiving part **650** in which the light source part **500** is accommodated.

Therefore, the first molding surface **911** molds the second surface **713**-*b* of the light guide film **713**. That is, when the first molding surface **911** is substantially parallel to the bottom surface **620**-*a*, the second surface **713**-*b* may be provided to be substantially parallel to the bottom surface **620**-*a*. According to another exemplary embodiment, when a portion of the first molding surface **911**, which is adjacent to the second sidewall **630**, is provided to be inclined, the light guide film **713** having the tapered shape may be provided. In detail, one end of the first molding surface **911**, which is extended toward the second sidewall **630**, is inclined to an opposite direction to a direction which the first molding surface **911** faces while being extended toward the second sidewall **630**. Accordingly, the third surface **713**-*c* of the light guide film **713** is provided to be substantially parallel to the upper surface of the cladding film **712** and the second surface **713**-*b* of the light guide film **713** is provided to have the shape corresponding to that of the first molding surface **911**. Consequently, the light guide film **713** has the tapered shape.

The second molding surface **912** molds the first surface **713**-*a* of the light guide film **713**. The third surface **713**-*c* is provided to correspond to the upper surface of the cladding film **712** that makes contact with the third surface **713**-*c*, and thus the third surface **713**-*c* is provided to be substantially parallel to the bottom surface **620**-*a*. The other surfaces of the light guide material **713**-*m*, which include the fourth surface **713**-*d*, are molded by the sidewalls of the base

chassis **600** including the first side wall **610**, which respectively make contact with the other surfaces.

FIGS. **11**A to **11**E are views showing a method of manufacturing a bottom chassis according to another exemplary embodiment of the invention.

Referring to FIGS. **11**A to **11**E, the method of manufacturing the bottom chassis **800** includes forming the base chassis **600**, forming the base pattern, forming the reflective film **711**, forming the cladding film **712**, and forming the light guide film **713**. In FIGS. **11**A to **11**E, the forming of the base chassis **600**, the forming of the reflective film **711**, the forming of the cladding film **712**, and the forming of the light guide film **713** are the same as those shown in FIGS. **9**A to **9**D, and thus detailed descriptions thereof will be omitted.

FIG. **11**A shows the forming of the base chassis **600**. In an exemplary embodiment, the base chassis **600** including the first sidewall **610**, the bottom plate **620**, and the second sidewall **630** is provided by a forge welding method or a casting method.

Referring to FIG. **11**B, the base pattern having the concavo-convex shape is disposed on the bottom surface **620**-*a*. To form the base pattern on the bottom surface **620**-*a*, the first recesses **750** are provided by recessing the bottom surface **620**-*a* to the rear surface of the bottom plate **620** facing the bottom surface **620**-*a*. The first recesses **750** are spaced apart from each other by the predetermined distance.

Referring to FIG. **11**C, the reflective film **711** is disposed on the bottom surface **620**-*a*. The reflective material is provided in the film area GA to have the uniform thickness. Thus, the second recesses **760** recessed from the reflective film **711** to the bottom surface **620**-*a* are provided to respectively correspond to the first recesses **750**. The second recesses **760** form the concavo-convex shape corresponding to the base pattern.

Referring to FIG. **11**D, the cladding film **712** is disposed on the reflective film **711**. The cladding material is provided on the reflective film **711** in the film area GA to have the uniform thickness. Thus, the third recesses **770** recessed from the cladding film **712** to the reflective film **711** are provided to respectively correspond to the second recesses **760**. The third recesses **770** form the concavo-convex shape corresponding to the base pattern.

Referring to FIG. **11**E, the light guide film **713** is disposed on the cladding film **712** in the film area GA. The guiding material is injection-molded on the cladding film **712** using the injection mold **900** as shown in FIG. **10**B. Accordingly, the pattern protrusions **780** are disposed only on the third surface **713**-*c*, so that the light guide pattern may be disposed only on the third surface **713**-*c* to correspond to the base pattern. However, the method of forming the light guide film **713** should not be limited to the above-mentioned method. In an exemplary embodiment, when the guiding material is laminated on the cladding film **712** at the uniform thickness as shown in FIG. **9**D, the light guide pattern may be disposed on the second surface **713**-*b* and the third surface **713**-*c* to correspond to the base pattern.

FIGS. **12**A and **12**B are views showing a method of forming a base pattern according to an exemplary embodiment of the invention. Referring to FIGS. **12**A and **12**B, the method of forming the base pattern includes aligning the base chassis **600** and forming the pattern. The base pattern is provided by a roll printing apparatus **920**. First, the bottom plate **620** is aligned to be disposed between a mold roll **921**, on which a protrusion **923** having a reverse shape to the base pattern is formed, and a base roll **922**. Then, the mold roll **921** and the base roll **922** are rotated to allow the bottom plate **620** to pass between the mold roll **921** and the base roll **922**, and thus the protrusion **923** having the reverse shape to the base pattern presses the bottom surface **620**-*a* while the bottom plate **620** passes through between the mold roll **921** and the base roll **923**. Thus, the first recesses **750** and the base pattern are provided in the bottom surface **620**-*a*.

FIGS. **13**A and **13**B are views showing a method of forming a base pattern according to another exemplary embodiment of the invention.

As shown in FIGS. **13**A and **13**B, a mold roll **921** includes a protrusion **923**-*a* having a reverse shape to the base pattern in order to form a first recesses **750**-*a*. Accordingly, the protrusion **923**-*a* having the reverse shape to the base pattern presses the bottom surface **620**-*a* while the bottom plate **620** passes through between the mold roll **921** and the base roll **922**. Thus, the first recesses **750**-*a* and the base pattern are disposed on the bottom surface **620**-*a*.

FIGS. **14**A to **14**C are views showing a method of forming a base pattern according to another exemplary embodiment of the invention. Referring to FIGS. **14**A to **14**C, the method of forming the base pattern includes aligning the base chassis **600**, forming the pattern, and separating an extrusion molding device **930**. The base pattern is provided by the extrusion molding device **930**. In the aligning of the base chassis **600**, the bottom plate **620** of the base chassis **600** is aligned with an extrusion mold **931** having a reverse shape **932** to the base pattern. In the forming of the pattern, the extrusion mold **931** is descended to the base chassis **600** to allow the reverse shape **932** to make contact with the bottom plate **620**. Then, when a pressure is applied to the extrusion mold **931**, the reverse shape **932** to the base pattern is printed on the bottom surface **620**-*a*, and thus the first recesses **750** and the base pattern are disposed on the bottom surface **620**-*a*. After that, the extrusion mold **931** is ascended to be separate from the base chassis **600**.

FIGS. **15**A and **15**B are views showing a method of forming a base pattern according to another exemplary embodiment of the invention. Referring to FIGS. **15**A and **15**B, the method of forming the base pattern includes aligning a laser unit **940** and forming a pattern. The base pattern is provided by the laser unit **940**. In the aligning of the laser unit **940**, the laser unit **940** is aligned on the base chassis **600** to correspond to the base pattern. In the forming of the pattern, a laser beam is irradiated onto the bottom surface **620**-*a* using the laser unit **940** to partially recess the bottom surface **620**-*a*, and thus the base pattern is formed.

Although the exemplary embodiments of the invention have been described, it is understood that the invention should not be limited to these exemplary embodiments but various changes and modifications can be made by one ordinary skilled in the art within the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. A bottom chassis comprising:

a base chassis which accommodates a light source part which emits a light;

a reflective film which is disposed on a bottom plate of the base chassis and includes a reflective material to reflect the light;

a cladding film disposed on the reflective film; and

a light guide film which is disposed on the cladding film, receives the light from the light source part through a first surface thereof, and guides the received light to exit through a second surface thereof as a plane light,

wherein the cladding film has a refractive index smaller than a refractive index of the light guide film,

wherein the bottom plate of the base chassis comprises a base pattern having a concavo-convex shape consisting of a plurality of concavities and a plurality of convexities defined in a bottom surface of the bottom plate of the base chassis which contacts the reflective film, and

wherein an opposing surface of the bottom plate of the base chassis which is opposite to the bottom surface is flat.

2. The bottom chassis of claim **1**, wherein the light guide film comprises a light guide pattern disposed on a third surface facing the second surface to guide the received light to the second surface, and the first surface connects the second surface and the third surface.

3. The bottom chassis of claim **2**, wherein the light guide pattern has a shape corresponding to the base pattern.

4. The bottom chassis of claim **3**, wherein the reflective film and the cladding film are sequentially stacked on the bottom plate, and each of the reflective film and the cladding film has the concavo-convex shape corresponding to the base pattern on the bottom plate and a uniform thickness.

5. The bottom chassis of claim **4**, wherein the light guide pattern comprises a pattern recess recessed from the third surface to the second surface and the pattern recess has a cone shape, an elliptical cone shape, a triangular pyramid shape, a quadrangular pyramid shape, a hexagonal pyramid shape, a cylinder shape, an elliptic cylinder shape, a triangular prism shape, a square column shape, or a hexagonal column shape.

6. The bottom chassis of claim **4**, wherein the light guide pattern comprises a pattern protrusion protruded from the third surface to the cladding film and the pattern protrusion has a cone shape, an elliptical cone shape, a triangular pyramid shape, a quadrangular pyramid shape, a hexagonal pyramid shape, a cylinder shape, an elliptic cylinder shape, a triangular prism shape, a square column shape, or a hexagonal column shape.

7. The bottom chassis of claim **1**, wherein the light guide film has a thickness of about 50 micrometers to about 300 micrometers.

8. The bottom chassis of claim **1**, wherein the cladding film has a thickness of about 10 micrometers to about 100 micrometers.

9. The bottom chassis of claim **1**, wherein the cladding film comprises silicon.

10. The bottom chassis of claim **1**, further comprising a first sidewall and a second sidewall,

wherein

the bottom plate comprises a first horizontal bottom plate, a second horizontal bottom plate, and an inclination bottom plate disposed between the first and second horizontal bottom plates,

the inclination bottom plate is extended from an end of the first horizontal bottom plate to an end of the second horizontal bottom plate and inclined to a rear surface of the first horizontal bottom plate,

the first sidewall is extended from the other end of the first horizontal bottom plate,

the second sidewall is extended from the other end of the second horizontal bottom plate to face the first sidewall, and

the light source part is disposed on the second horizontal bottom plate.

11. The bottom chassis of claim **10**, wherein

the reflective film and the cladding film are disposed on the first and second horizontal bottom plates and the inclination bottom plate and have a uniform thickness, respectively, and

a width of the first surface of the light guide film in a direction vertical to the bottom plate is greater than a width of a fourth surface facing the first surface.

12. A method of manufacturing a bottom chassis, the method comprising:

forming a base chassis;

providing a reflective material on a bottom surface of the base chassis to form a reflective film;

providing a cladding material on an upper surface of the reflective film to form a cladding film; and

providing a guiding material on an upper surface of the cladding film to form a light guide film, wherein the cladding material has a refractive index smaller than a refractive index of the guiding material,

wherein the forming the base chassis comprises forming a base pattern having a concavo-convex shape consisting of a plurality of concavities and a plurality of convexities defined in the bottom surface which contacts the reflective film, and

wherein an opposing surface of the bottom plate of the base chassis which is opposite to the bottom surface is flat.

13. The method of claim **12**, wherein

the forming the reflective film comprises providing the reflective material on the base pattern at a uniform thickness such that the reflective film has the concavo-convex shape corresponding to the base pattern,

the forming the cladding film comprises providing the cladding material on the concavo-convex shape of the reflective film at a uniform thickness such that the cladding film has the concavo-convex shape corresponding to the concavo-convex shape of the reflective film, and

the forming the light guide film comprises forming a light guide pattern corresponding to the concavo-convex shape on a surface thereof which contacts with the cladding film.

14. The method of claim **13**, wherein the forming the base pattern comprises:

aligning a laser unit along the base pattern; and

irradiating a laser beam on an upper surface of the base chassis using the laser unit to form the base pattern on the bottom surface of the base chassis.

15. The method of claim **13**, wherein the forming the base pattern comprises:

aligning an extrusion mold having a reverse shape to the base pattern on the base chassis;

applying a pressure onto the extrusion mold to form the base pattern on the bottom surface of the base chassis; and

separating the extrusion mold from the base chassis.

16. The method of claim **13**, wherein the forming the base pattern comprises:

interposing the base chassis between a mold roll having a reverse shape to the base pattern and a base roll; and

rotating the mold roll and the base roll to form the base pattern on the bottom surface of the base chassis.

17. The method of claim **12**, wherein the light guide film is provided by injection-molding the guiding material using an injection mold.

18. A display apparatus comprising:

a light source part which emits a light;

a bottom chassis which receives the light from the light source part, converts the light to a plane light and comprises:

a base chassis which accommodates the light source part;

a reflective film disposed on a bottom plate of the base chassis and including a reflective material to reflect the light;

a cladding film disposed on the reflective film; and

a light guide film which is disposed on the cladding film, receives the light from the light source part through a first surface thereof, and guides the received light to exit through a second surface thereof, and

a display panel which is disposed on the light guide film, receives the plane light from the bottom chassis and transmits the plane light based on an image data to display an image,

wherein the cladding film has a refractive index smaller than a refractive index of the light guide film,

wherein the cladding film is interposed between the reflective film and the display panel, and wherein the light guide film is interposed between the display panel and the cladding film, and

wherein the cladding film comprises a cladding pattern having a first concavo-convex shape.

19. The display apparatus of claim **18**, wherein the light guide film comprises a light guide pattern disposed on a third surface facing the second surface to guide the received light to the second surface, and the first surface connects the second surface and the third surface.

20. The display apparatus of claim **19**, wherein the light guide pattern has a shape corresponding to the base pattern.

21. The display apparatus of claim **18**, wherein the bottom plate of the base chassis comprises a base pattern having a second concavo-convex shape, and wherein the first and second concavo-convex shapes have substantially same shape.

22. The display apparatus of claim **18**, wherein the first concavo-convex shape includes a plurality of recesses defined at a upper surface of the cladding film, each of the plurality of recesses is recessed towards the reflective film.

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